

30102 - Chemistry

Información del Plan Docente

Academic Year	2016/17
Academic center	175 - Escuela Universitaria Politécnica de La Almunia 179 - Centro Universitario de la Defensa - Zaragoza
Degree	425 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering 457 - Bachelor's Degree in Industrial Organisational Engineering
ECTS	6.0
Course	1
Period	Half-yearly
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

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The learning process designed for this subject is based on the following :

Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The current subject is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, at the same time supported by other activities .

The organization of teaching will be carried out using the following steps:

— **Theory Classes** : Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them.

— **Practical Classes** : The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.

— **Laboratory Workshop** : The lecture group is divided up into various groups, according to the number of registered students, but never with more than 16 students, in order to make up smaller sized groups.

— **Individual Tutorials**: **Those carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.**

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In order to get the objectives described in Section 3.1 the following learning activities will be carried out: lectures, practical and problem solving sessions, laboratory sessions.

5.2.Learning activities**SPECIALIZATION IN BUSINESS**

The programme offered to the student to help them achieve their target results is made up of the following activities

Involves the active participation of the student, in a way that the results achieved in the learning process are developed, not taking away from those already set out, the activities are the following:

— **Face-to-face generic activities :**

● **Theory Classes** : The theoretical concepts of the subject are explained and illustrative examples are developed as support to the theory when necessary.

● **Practical Classes** : Problems and practical cases are carried out, complementary to the theoretical concepts studied.

● **Laboratory Workshop** : This work is tutored by a teacher, in groups of no more than 20 students.

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– **Generic non-class activities :**

• Study and understanding of the theory taught in the lectures.

• Understanding and assimilation of the problems and practical cases solved in the practical classes.

• Preparation of seminars, solutions to proposed problems, etc.

• Preparation of laboratory workshops, preparation of summaries and reports.

• Preparation of the written tests for continuous assessment and final exams.

The subject has 6 ECTS credits, which represents 150 hours of student work in the subject during the trimester, in other words, 10 hours per week for 15 weeks of class.

A summary of a weekly timetable guide can be seen in the following table. These figures are obtained from the subject file in the Accreditation Report of the degree, taking into account the level of experimentation considered for the said subject is moderate.

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Activity	Weekly school hours
Lectures	2
Laboratory Workshop	2
Other Activities	6

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1. lectures,
2. practical and problem solving sessions,
3. laboratory sessions.

5.3.Program

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THEORETICAL CONTENTS

Module	Contents
1. THE ATOM AND THE PERIODIC SYSTEM	Topic 1.- The atom. Elemental particles. Atomic models. The Bohr atom. The quantum mechanical model. Atomic orbitals; quantum numbers. Principles for the electronic construction of atoms.

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	<p>Topic 2.- General overview of the periodic table</p> <p>Description of the current periodic table: groups and periods. Study of the electron shell and the periodic system. Periodic properties.</p>
<p>2. THE CHEMICAL BOND</p>	<p>Topic 3 .- The ionic bond</p> <p>General characteristics of the ionic bond. Network energy. General properties of ionic compounds.</p> <p>Topic 4 .- The covalent bond</p> <p>Simplified model: the Lewis theory. Bond polarity and geometry. Valence bond theory. Orbital hybridization. Molecular orbital theory.</p> <p>Topic 5 .- The metallic bond</p> <p>General characteristics of metals. Theories of the metallic bond: the electron sea theory and valence bond theory. Alloys: classes.</p>
<p>3. BONDS BETWEEN MOLECULES</p>	<p>Topic 6 .- Intermolecular bonds</p> <p>Van der Waal forces. Hydrogen bonds.</p>
<p>4. AGGREGATION STATES</p>	<p>Topic 7 .- The gas state</p> <p>General characteristics of gases. Laws</p>

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	<p>that govern the gas state. Equations of state. Kinetic theory. Gas mixtures: Dalton's Law. Gas diffusion and effusion: Graham's Law. Real gases: The Van der Waal equation.</p> <p>Topic 8 .- The liquid state</p> <p>General characteristics of liquids. Vapour pressure. The effect of temperature on vapour pressure. Critical phenomena. Condensation of vapours and gases. Solidification.</p> <p>Topic 9 .- The solid state</p> <p>Characteristics of solids. Classes of crystal network. Classes of solids based on bonding type. The phase rule and the triple point.</p>
<p>5. INTRODUCTION TO THE STUDY OF SOLUTIONS</p>	<p>Topic 10 .- Introduction to the study of solutions</p> <p>Disperse systems. Types of solutions. Means of expressing concentration. Solid-in-liquid solutions. Liquid-in-liquid solutions. Gas-in-liquid solutions. Colligative properties of solutions. Colloidal solutions.</p>
<p>6. INTRODUCTION TO THE STUDY OF REACTIONS</p>	<p>Topic 11 .- Chemical equilibrium</p> <p>The concept of reaction rate. Reversible and irreversible reactions. Chemical equilibrium: the equilibrium constant. Le Chatelier's principle. Stable, unstable and metastable systems.</p>

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	<p>Topic 12.- Neutralisation reactions</p> <p>The acid-base concept. Aqueous solutions: pH of aqueous solutions. Acid-base strengths. Equilibrium constants. Salt hydrolysis.</p>
7. ORGANIC CHEMISTRY	<p>Topic 13.- Organic chemistry</p> <p>The properties of carbon. Types of organic substances Isomers. Organic chemical reactions. Polymers</p>

PRACTICAL CONTENTS

Each student will undertake a total of six practicals during the academic year during the period assigned for them. In order to pass the subject, students must attend these practicals and submit a report once they have been completed.

The content of the practical course is as follows:

Practical 1	Standards in Chemical Laboratory
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	<i>Techniques, Equipment and Safety</i>
Practical 2	Solution Preparation <i>Na₂CO₃ 0,1 M from Na₂CO₃ solid; CaCl₂ 0,1 M from CaCl₂ 2 M</i>
Practical 3	Filtration <i>Gravity Filtration and Vacuum Filtration</i>
Practical 4	Volumetric Analysis <i>Water hardness; carbonates and bicarbonates in water.</i>
Practical 5	Distillation

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Contents

Unit 1. Chemistry and matter

1.1. Basic concepts

1.2. Fundamental laws of chemical reactions. Atoms

1.3. Compounds and chemical formula

- 1.4. Composition of compounds
- 1.5. Mixtures, solutions and solubility
- Unit 2. Chemical reactions and stoichiometry
 - 2.1. Chemical reaction and chemical equation
 - 2.2. Stoichiometry of chemical reactions
 - 2.3. Gases
 - 2.3. Aqueous reactions
- Unit 3. Chemical equilibrium
 - 3.1. Basic concepts
 - 3.2. Equilibrium constant and chemical equation
 - 3.3. Numerical importance of the equilibrium constant
 - 3.4. The reaction quotient, Q
 - 3.5. Le Chatelier's principle
 - 3.6. Acid-base equilibria and the pH scale
- Lab. session 1: Solutions and titration
- Unit 4. Energy and Chemistry
 - 4.1. Basic concepts
 - 4.2. The First Law of Thermodynamics: heat, work and enthalpy
 - 4.3. Spontaneous processes
 - 4.4. Entropy.
 - 4.6. The Second Law of Thermodynamics.
- Unit 5. Chemical kinetics
 - 5.1. Reaction rates
 - 5.2. Concentration and reaction rate
 - 5.3. Rate laws
 - 5.4. The change of concentration with time.
 - 5.5. Temperature and reaction rate
 - 5.6. Reaction mechanisms
 - 5.7. Catalysis
- Lab. session 2: The aluminothermic reaction
- Unit 6. Atomic models
 - 6.1. From classical physics to quantum mechanics
 - 6.2. Line spectra and the Bohr model
 - 6.3. The wave behaviour of matter
 - 6.4. Quantum mechanics and atomic orbitals
 - 6.5. Many-electron atoms
 - 6.6. Electronic configurations and the Periodic Table
 - 6.7. Periodic properties
- Unit 7. Chemical bond I
 - 7.1. Chemical bonds, Lewis symbols and the octet rule
 - 7.2. Ionic bonding
 - 7.3. Covalent bonding
 - 7.4. Strength of covalent bonds
- Unit 8. Chemical bond II
 - 8.1. The VSEPR model
 - 8.2. Molecular polarity
 - 8.3. Molecular-orbital model
 - 8.4. Molecular-orbital model for metals
- Unit 9. Intermolecular forces and liquids
 - 9.1. Intermolecular forces
 - 9.2. Solubility and the solution process
 - 9.3. Phases, phase changes and phase diagrams
 - 9.4. Liquids: boiling point, vapor pressure, surface tension, viscosity
- Unit 10. Solids
 - 10.1. Amorphous solids and the short-range order. Glass transition temperature
 - 10.2. Crystalline solids, the long-range order and the unit cell
 - 10.3. Bonding in solids

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Unit 11. Materials

11.1. Materials science and classes of materials

11.2. Ceramics

11.3. Polymers

11.4. Alloys

11.5. Semiconductors

5.4.Planning and scheduling

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SECTION	Topic	Nº hours
0 y 1	Presentation. Atom (<i>Topic 1</i>) and the Periodic System (<i>Topic 2</i>)	10
2 y 3	The Chemical Bond (<i>Topics 3, 4 y5</i>) and Intermolecular Bonds(<i>Topic 6</i>)	12
4	Aggregation Sates (<i>Topics 7, 8 y 9</i>)	6
5	Introduction to the study of solutions (<i>Topic 10</i>)	8
6	Introduction to the study of reactions (<i>Topics 11 y 12</i>)	8
7	Organic Chemistry (Topic 13)	4
	Practical Course	5
	Exams	7
TOTAL		60

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The dates of the final exams will be those that are officially published at <http://www.eupla.es/secretaria/academica/examenes.html>.

The written assessment tests will be related to the following topics:

- **Test 1** : Topics 1,2.

- **Test 2** : Topics 3,4,5,6.

- **Test 3** : Topics 7,8,9,10.

- **Test 4** : Topics 11,12.

5.5.Bibliography and recommended resources

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References and resources

Basic material prepared by the lecturer:

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GONZÁLEZ PAÚLES, J. Química General. Apuntes del curso práctico. *Ed. Eupla.2010. ISBN 978-84-692-8044-7*

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- Química : la ciencia central / Theodore L. Brown ... [et al.] ; con la colaboración de Patrick Woodward ; traducción, Laura Fernández Enríquez ; revisión técnica, María Aurora Lanto Arriola . 12ª ed. México : Pearson Educación, 2014
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- Brown, L. S. y Holme, T. A. Chemistry for Engineering Students. 2nd ed. México D.F. : Cengage Learning, 2011
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