

## 28802 - Chemistry

### Syllabus Information

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**Academic Year:** 2019/20

**Subject:** 28802 - Chemistry

**Faculty / School:** 175 - Escuela Universitaria Politécnica de La Almunia

**Degree:** 424 - Bachelor's Degree in Mechatronic Engineering

**ECTS:** 6.0

**Year:** 1

**Semester:** First semester

**Subject Type:** Basic Education

**Module:** ---

## 1.General information

### 1.1.Aims of the course

The aim of the course is the acquisition of a basic view of the structure of matter in connection to its properties and the chemical transformations that matter can undergo. Another objective is the introduction of organic chemistry.

### 1.2.Context and importance of this course in the degree

The course belongs to the Basic Training module and is scheduled in the first semester of the first year of the Degree in Mechatronic Engineering. It provides the necessary chemical knowledge to any graduate in Engineering studies, particularly for the understanding of concepts that will be acquired in other courses such as Environment and Materials Engineering.

### 1.3.Recommendations to take this course

It is advisable to have taken the subject of Chemistry in High School.

## 2.Learning goals

### 2.1.Competences

### 2.2.Learning goals

### 2.3.Importance of learning goals

## 3.Assessment (1st and 2nd call)

### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

## 4.Methodology, learning tasks, syllabus and resources

### 4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

- **Lectures:** 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.
- **Practice Sessions:** 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.

## 4.2.Learning tasks

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.

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

## 4.3.Syllabus

The course will address the following topics:

### THEORETICAL CONTENTS

Module	Contents
<b>1. THE ATOM AND THE PERIODIC SYSTEM</b>	<p>Topic 1.- <b>The Atom.</b> Elemental particles. Atomic models. The Bohr atom. The quantum mechanical model. Atomic orbitals; quantum numbers. Principles for the electronic construction of atoms.</p> <p>Topic 2.- <b>General overview of the periodic table</b> Description of the current periodic table: groups and periods. Study of the electron shell and the periodic system. Periodic properties.</p>
<b>2. THE CHEMICAL BOND</b>	<p>Topic 3.- <b>The ionic bond</b> General characteristics of the ionic bond. Network energy. General properties of ionic compounds.</p> <p>Topic 4.- <b>The covalent bond</b> Simplified model: the Lewis theory. Bond polarity and geometry. Valence bond theory. Orbital hybridization. Molecular orbital theory.</p> <p>Topic 5.- <b>The metallic bond</b> General characteristics of metals. Theories of the metallic bond: the electron sea theory and valence bond theory. Alloys: classes.</p>
<b>3. BONDS BETWEEN MOLECULES</b>	<p>Topic 6.- <b>Intermolecular bonds</b> Van der Waal forces. Hydrogen bonds.</p>
<b>4. AGGREGATION STATES</b>	<p>Topic 7.- <b>The gas state</b> General characteristics of gases. Laws 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.- <b>The liquid state</b> 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.- <b>The solid-state</b> Characteristics of solids. Classes of crystal network. Classes of solids based on bonding type. The phase rule and the triple point.</p>
<b>5. INTRODUCTION TO THE STUDY OF SOLUTIONS</b>	<p>Topic 10.- <b>Introduction to the study of solutions</b> 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>

<b>6. INTRODUCTION TO THE STUDY OF REACTIONS</b>	<p>Topic 11.- <b>Chemical equilibrium</b> The concept of reaction rate. Reversible and irreversible reactions. Chemical equilibrium: the equilibrium constant. Le Chatelier's principle. Stable, unstable and metastable systems.</p> <p>Topic 12.- <b>Neutralisation reactions</b> The acid-base concept. Aqueous solutions: pH of aqueous solutions. Acid-base strengths. Equilibrium Constants. Salt hydrolysis.</p>
<b>7. INTRODUCTION TO THE CHEMICAL ANALYSIS AND THE ORGANIC CHEMISTRY</b>	<p>Topic 13.- <b>Introduction to Analytical Chemistry in Materials</b> Gravimetric Methods. Volumetric Methods. Spectroscopic Methods and Others</p> <p>Topic 14.- <b>Organic Chemistry</b> Organic Compounds and Formulation. Isomerism. Types of Chemical Bonds. Organic Reactions.</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:

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

#### 4.4.Course planning and calendar

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	Intro to Analysis Chemistry and Organic Chemistry ( <i>Topics 13 y 14</i> )	4
	Practical Course	6
	Exams	6
<b>TOTAL</b>		60

The dates of the final exams will be those that are officially published at <http://www.eupla.unizar.es/asuntos-academicos/examenes>

#### 4.5. Bibliography and recommended resources

##### REFERENCES AND RESOURCES

Basic material prepared by the lecturer:

GONZÁLEZ PAÚLES, J. y BURBANO GARCÍA, G. *Apuntes de Química para el Grado en Ingeniería Civil*. Ed. Eupla. 2011. ISBN 978 84 694 0618 2

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

**Power Point** in moodle platform (<https://moodle.unizar.es/>)

[http://biblos.unizar.es/br/br\\_citas.php?codigo=28802&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=28802&year=2019)