

28708 - Chemistry

Syllabus Information

Academic Year: 2019/20
Subject: 28708 - Chemistry
Faculty / School: 175 -

Degree: 423 - Bachelor's Degree in Civil Engineering

ECTS: 6.0

Year: 1

Semester: Second 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. Also, knowledge of the composition of the Earth and the geological processes, as well as the environmental impact of construction waste.

1.2. Context and importance of this course in the degree

The course belongs to the Basic Training module and is scheduled in the second semester of the first year of the Degree in Civil 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 the Sixth Form at 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)

1: Continuous assessment

Students need to attend at least 80% of the in class/laboratory sessions. The assessment will include:

1. Assignments and laboratory practice: 10% of final mark.
2. 3 written tests: 90% of final mark. Each test must be passed with at least 5/10

2: Final global test

Students who cannot attend at least 80% of class or who fail to pass the subject by continuous assessment or wish to obtain a better mark.

It will include theory and applied theory: 100% of final mark.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

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

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.

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

THEORETICAL CONTENTS

Module 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.

Topic 2.- **General overview of the periodic table**

Description of the current periodic table: groups and periods. Study of the electron shell and the periodic system. Periodic properties.

Module 2.- *THE CHEMICAL BOND*

Topic 3.- **The ionic bond**

General characteristics of the ionic bond. Network energy. General properties of ionic compounds.

Topic 4.- **The covalent bond**

Simplified model: the Lewis theory. Bond polarity and geometry. Valence bond theory. Orbital hybridization. Molecular orbital theory.

Topic 5.- **The metallic bond**

General characteristics of metals. Theories of the metallic bond: the electron sea theory and valence bond theory. Alloys: classes.

Module 3.- *BONDS BETWEEN MOLECULES*

Topic 6.- Intermolecular bonds

Van der Waal forces. Hydrogen bonds.

Module 4.- AGGREGATION STATES

Topic 7.- The gas state

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.

Topic 8.- The liquid state

General characteristics of liquids. Vapour pressure. The effect of temperature on vapour pressure. Critical phenomena. Condensation of vapours and gases. Solidification.

Topic 9.- The solid state

Characteristics of solids. Classes of crystal network. Classes of solids based on bonding type. The phase rule and the triple point.

Module 5.- INTRODUCTION TO THE STUDY OF SOLUTIONS

Topic 10.- Introduction to the study of solutions

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.

Module 6.- INTRODUCTION TO THE STUDY OF REACTIONS

Topic 11.- Chemical reaction. Stoichiometry.

Chemical Equations. The Limiting Reactant Concept and Percent Yields from Chemical Reactions.

Module 7.- INTRODUCTION TO STUDY OF THE MATERIALS AND ENVIRONMENTAL IMPACT

Topic 12.- Introduction to Analytical Chemistry in Materials

Gravimetric Methods. Volumetric Methods. Spectroscopic Methods and Others

Topic 13.- Environmental Impact and Waste Management in Construction

Introduction. Environmental Impact Assessments. Legislation.

Module 8.- INTRODUCTION TO THE GEOLOGY

Topic 14.- Introduction to the Geology. Rocks.

History. Structure and Composition of the Earth. Geological Processes. Rocks and Minerals. Clasification of Rocks.

PRACTICAL CONTENTS

Practical 1. Standards in Chemical Laboratory

Techniques, Equipment and Safety

Practical 2. Solution Preparation

Na₂CO₃ 0,1 M from Na₂CO₃ solid; CaCl₂ 0,1 M from CaCl₂ 2 M

Practical 3. Filtration

Gravity Filtration and Vacuum Filtration

Practical 4. Volumetric Analysis

Water hardness; carbonates and bicarbonates in water.

Practical 5. Distillation

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 Intermoleculars Bonds(<i>Topic 6</i>)	12

4	Aggregation Sates (<i>Topics 7, 8, 9</i>)	6
5 and 6	Introduction to the study of solutions and reactions (<i>Topics 10, 11</i>)	14
7 and 8	Intro to Study of the Materials and Environmental Impact. Intro to the Geology. (<i>Topics 12, 13, 14</i>)	6
	Practical Course	6
	Exams	6
TOTAL		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

The bibliography can be consulted on webpage http://biblos.unizar.es/br/br_citas.php?codigo=28708&year=2019

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 Platform Moodle (<https://moodle2.unizar.es/>)