

## 28708 - Chemistry

### Syllabus Information

**Academic Year:** 2022/23

**Subject:** 28708 - Chemistry

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

**Degree:** 423 - Bachelor's Degree in Civil 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. Also, knowledge of the composition of the Earth and the geological processes, as well as the environmental impact of construction waste.

These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree. Goal 6: Clean Water and Sanitation.

### 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 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

G01.- Organizational and planning ability.

G02.- Ability to solve problems.

G03.- Ability to make decisions.

G04.- Aptitude for oral and written communication in the native language.

G05.- Ability for analysis and synthesis.

G06.- Ability to manage information.

G07.- Ability to work in a team.

G08.- Ability for critical thinking.

G09.- Ability to work in an interdisciplinary team.

G10.- Aptitude to work in an international context.

G11.- Ability to improvise and adapt to face new situations.

G12.- Aptitude for leadership.

G13.- Positive social attitude towards social and technological innovations.

G14.- Ability to think, discuss and present your own ideas.

G15.- Communication skills through words and images.

G16.- Ability to search, analyze and select information.

G17.- Ability for autonomous learning.

G23.- Knowledge and understanding of respect for fundamental rights, equal opportunities for women and men, universal accessibility for people with disabilities, and respect for values. typical of the culture of peace and democratic values.

G24.- Promotion of entrepreneurship.

G25.- Knowledge of information and communication technologies

CB1.- Knowledge in an area of ??study that starts at secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve avant-garde knowledge from your field of study.

CB2.- Application of their knowledge to their work in a professional way and possession of the competences that are usually demonstrated through the production and defense of arguments and problem solving within their area of ??study.

CB3.- Ability to collect and interpret relevant data (usually within of their study area), to make judgments that include a reflection on relevant issues of a social, scientific or ethical nature.

CB4.- Transmission of information, ideas, problems and solutions to a specialized and non-specialized audience.

CB5.- Development of those learning skills necessary to undertake further studies with a high degree of autonomy.

C02.- Theoretical and practical knowledge of the chemical, physical, mechanical and technological properties of the most widely-used materials in construction.

## **2.2. Learning goals**

Explaining the concepts related to the structure of matter, solutions and reactions as well as the geological foundations of the Earth's crust.

Applying the acquired knowledge of Chemistry and Geology.

Using numerical methods in solving the chemical problems that are proposed.

Solving questions and problems of General Chemistry.

Showing an adequate use of basic laboratory equipment to carry out simple chemical experiments.

Having the ability to handle chemistry language; particularly symbolic and formal language.

Interpreting and presenting contents of basic scientific texts.

## **2.3. Importance of learning goals**

This subject is included in the basic training module of the degree, which, in a broad sense, aims to unify the knowledge of students and prepare them to tackle more specific subjects of the degree. In this sense, together with the rest of the basic

subjects, the course Fundamentals of Construction Materials contributes to laying the foundations of a scientific model and, in addition, to providing future graduates with the necessary chemical concept tools to tackle other disciplines of the degree that they need. . Finally the Graduate will learn and be able to use the basic chemistry tools that will allow him to develop the professional competences related to this course.

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

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

The assessment process will include two types of action:

- **A split assessment system**, which will be carried out throughout the course and which will include:

Carrying out practice tasks in the laboratory.

Carrying out one or more works on practical aspects of the course.

Carrying out partial tests that can assess the knowledge acquired.

- **A global assessment test** to be carried out if the continuous assessment process has not been successful.

#### **SPLIT ASSESSMENT SYSTEM**

In order to be eligible for this assessment system, the student must attend class regularly, with at least 80% attendance in classroom activities (classes, practice tasks, technical visits, etc.). In the split assessment system, the teacher will assess the participation and works derived from laboratory practice tasks or others. Finally, the student must take several written tests that show the knowledge acquired and the ability to solve practical problems. The criteria of Assessment to be applied will be as follows:

##### **Laboratory practice tasks and assignments:**

It will account for 10% of the final grade and will be carried out according to the assessment of problems, questions or assignments related to the practices carried out in the laboratory or to other topics specific to the course that might appear, requiring at least a 5 in this section in order to pass the course. If the practical course could not be carried out, it would be replaced by the completion of a job, which would score in the same measure.

##### **Partial assessment tests:**

There will be two partial tests. Each of them will have a theory and practice load of approximately 50% each. This part will account for 90% of the final grade and to be able to pass it, it is necessary to have passed the two tests or, having passed one of them, to have a mark not lower than 3.

Students who, not having passed the previous criteria, might have a failed partial test must go to the final global exam to pass the missing parts.

#### **GLOBAL FINAL ASSESSMENT TEST**

This test must be seated by those students who have not chosen the split assessment system or those who, having opted for such a system, were not successful. The latter should only go in for the missing partial tests.

Students who, having passed the split assessment system, wish to increase their grade may also take this test. In this case, they should complete the whole test.

The test will be written and will consist of specific or applied to practical questions and problems theory. The theory and practice load will be approximately 50% each. In addition, to pass the course, you must have completed the practical activities and passed the corresponding project (or, failing that, the work to be carried out if the practicals could not be carried out).

### 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 theory sessions, practice sessions, workshops, and tutorials.

The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

## 4.2. Learning tasks

This course is organized as follows:

- **Lectures:** Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the course are displayed, highlighting the fundamentals, 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.
- **Workshops:** 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.
- **Tutorials:** Carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.

This course 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 course file in the Accreditation Report of the degree, taking into account the level of experimentation considered for this course is moderate.

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

## 4.3. Syllabus

This course will address the following topics:

### THEORY CONTENTS

#### Section 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.

#### Section 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.

### Section 3.- *BONDS BETWEEN MOLECULES*

#### Topic 6.- **Intermolecular bonds**

Van der Waal forces. Hydrogen bonds.

### Section 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.

### Section 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.

### Section 6.- *INTRODUCTION TO THE STUDY OF REACTIONS*

#### Topic 11.- **Chemical reaction. Stoichiometry.**

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

### Section 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.

### Section 8.- *INTRODUCTION TO THE GEOLOGY*

#### Topic 14.- **Introduction to Geology. Rocks.**

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

## **PRACTICE SESSIONS**

### **Practice 1. Standards in Chemical Laboratory**

*Techniques, Equipment, and Safety*

### **Practice 2. Solution Preparation**

*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*

### **Practice 3. Filtration**

*Gravity Filtration and Vacuum Filtration*

### **Practice 4. Volumetric Analysis**

*Water hardness; carbonates and bicarbonates in the water.*

### **Practice 5. Distillation**

## **4.4. Course planning and calendar**

SECTION	Topic	N° 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, 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 Geology. (Topics 12, 13, 14)	6
	Practical Course	6
	Exams	6
<b>TOTAL</b>		60

Further information concerning the timetable, classroom, office hours, assessment dates ( <http://www.eupla.unizar.es/asuntos-academicos/examenes>) and other details regarding this course will be provided on the first day of class or please refer to the Faculty of EUPLA website and Moodle.

#### 4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28708>