Universidad Zaragoza

Academic Year/course: 2021/22

39602 - Chemistry

Syllabus Information

Academic Year: 2021/22
Subject: 39602 - Chemistry
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 608 -
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 and Industrial Organisational 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

GI03 Having knowledge in basic and technological issues, which will enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

GI04 Solving problems with initiative, decision making, creativity, critical thinking and communicating and transferring knowledge, abilities and skills in the field of Industrial Engineering and particularly in the scope of industrial mechatronics.

GC02 Interpreting experimental data, contrasting them with the theoretical ones and draw conclusions.

GC03 Abstraction and logical thinking.

GC04 Learning in a continuous, directed and autonomous way.

GC05 Evaluating alternatives.

GC07 Leading a team as well as being a committed member of it.

GC08 Locating technical information, as well as its understanding and evaluation.

GC10 Producing technical documentation and presenting it with the help of appropriate computer tools.

GC11 Communicating their thinking and designs clearly to specialized and non-specialized audiences.

EB04 Understanding and applying the basic knowledge principles of general chemistry, organic and inorganic chemistry and its applications in engineering.

2.2. Learning goals

Explaining the concepts related to the structure of matter, solutions and reactions

Applying the acquired knowledge of Chemistry.

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

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:

- 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.

If classroom teaching were not posssible due to health reasons, it would be carried out on-line.

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**

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

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** *Techniques, Equipment and Safety*
Practical 2	**Solution Preparation** *Na_2CO_3 0,1 M from Na_2CO_3 solid; $CaCl_2$ 0,1 M from $CaCl_2$ 2 M*
Practical 3	**Filtration** *Gravity Filtration and Vacuum Filtration*
Practical 4	***Volumetric Analysis*** *Water hardness; carbonates and bicarbonates in the water.*
Practical 5	**Distillation**

4.4. Course planning and calendar

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

SECTION	Topic	Nº hours
0 y 1	Presentation. Atom *(Topic 1)* and the Periodic System *(Topic 2)*	10
2 y 3	The Chemical Bond *(Topics 3, 4 y5)* and Intermolecular *Bonds(Topic 6)*	12
4	Aggregation Sates *(Topics 7, 8 y 9)*	6
5	Introduction to the study of solutions *(Topic 10)*	8
6	Introduction to the study of reactions *(Topics 11 y 12)*	8
7	Intro to Analysis Chemistry and Organic Chemistry (Topics 13 y 14)	4
	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

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=39602