30102 - Chemistry

Información del Plan Docente

Academic Year	2018/19
Subject	30102 - Chemistry
Faculty / School	175 - Escuela Universitaria Politécnica de La Almunia 179 - Centro Universitario de la Defensa - Zaragoza
Degree	457 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering 425 - Bachelor's Degree in Industrial Organisational Engineering
ECTS	6.0
Year	1
Semester	Half-yearly
Subject Type	Basic Education
Module	

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

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

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

30102 - Chemistry

- 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 the previous sections the following learning activities will be carried out: lectures, practical and problem solving sessions, laboratory sessions.

4.2.Learning tasks

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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

30102 - Chemistry

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

4.3.Syllabus

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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. 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.

30102 - Chemistry

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**

30102 - Chemistry

	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.

30102 - Chemistry

7. ORGANIC CHEMISTRY	Topic 13.**- Organic chemistry** The properties of carbon. Types of organic substances Isomers. Organic chemical reactions. Polymers

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.*

30102 - Chemistry

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 Chatêlier'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
Unit 11. Materials
11.1. Materials science and classes of materials
11.2. Ceramics
11.3. Polymers
11.4. Alloys
11.5. Semiconductors

4.4.Course planning and calendar

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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 Intermoleculars *Bonds(Topic 6)*	12
4	Aggregation Sates *(Topics 7, 8 y 9)*	6

30102 - Chemistry

5	Introduction to the study of solutions *(Topic 10)*	8
6	Introduction to the study of reactions *(Topics 11 y 12)*	8
7	Organic Chemistry (Topic 13)	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

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Before the start of the semester the course additional information will be published in the Moodle platform, which can be consulted at http://moodle.unizar.es after authentication with the student's username and password.

This information will include the course planning, materials, bibliography and other recommendations to follow the course.

Information about general course calendars and timetables can also be found at the website of the Centro Universitario de la Defensa: http://cud.unizar.es.

4.5.Bibliography and recommended resources