UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: FOUNDATIONS OF CHEMISTRY
Code: 57702
Type: BASIC
ECTS credits: 6
Degree: 344 - CHEMICAL ENGINEERING
Academic year: 2023-24
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Group(s): 21
Year: 1
Duration: First semester
Main language: Spanish
Second language:
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **YOLANDA DIAZ DE MERA MORALES** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Edificio Marie Curie, segunda planta, despacho 2.05	QUÍMICA FÍSICA	926052872	yolanda.diaz@uclm.es	Monday and Wednesday: from 16:00h to 18:00h Tuesday and Thursday: from 12:00h to 13:00h

Lecturer: **ALBERTO NOTARIO MOLINA** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Edificio Marie Curie, primera planta	QUÍMICA FÍSICA	6347	alberto.notario@uclm.es	Monday: from 10:00h to 13:00h Tuesday and Thursday: from 10:00h to 11:00h

2. Pre-Requisites

No prerequisites are established for this subject. It is recommended to take the zero course of Chemistry (which contains Formulation) offered by the Faculty of Chemical Sciences and Technologies since the student must know the nomenclature of inorganic compounds according to the IUPAC rules, as well as the most common traditional formulations.

3. Justification in the curriculum, relation to other subjects and to the profession

It is essential that the student of the Degree in Chemical Engineering acquires a solid knowledge of the foundations and bases of Chemistry. The Fundamentals of Chemistry subject intends for the student to deepen the understanding of chemical concepts and acquire the necessary skills for their application to the practical cases that will be presented both in their professional future and when studying other subjects of the study plan. Specifically, this subject will address the description of the structure of matter, the chemical bond, the states of aggregation and the different types of equilibrium.

Fundamentals of Chemistry is a basic subject, it will be taught in the first semester of the first year and constitutes an essential starting point for the correct learning of other subjects of the Chemical Engineering degree.

4. Degree competences achieved in this course

Course competences

Code	Description
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
E04	Ability to understand and apply the principles of basic knowledge of general chemistry, organic and inorganic chemistry and their applications in engineering.
E25	Manipulate chemicals safely and environmentally
G03	Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and give them versatility to adapt to new situations.
G14	Proper oral and written communication
G18	Synthesis capacity
G20	Ability to analyze and solve problems
G21	Ability to learn and work autonomously
G22	Ability to apply theoretical knowledge to practice

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To have the capacity for synthesis, being critical and objective.

To have the capacity for initiative to raise and solve specific problems of Chemistry, as well as to interpret the results obtained.

To have the ability to work autonomously in a laboratory and to interpret experimental results.

To have the capacity to search for information, its analysis, interpretation and use for practical purposes.

To develop your ability to work in a team.
To master stoichiometric adjustment, calculation of concentrations and systems and conversion of units.
To know the different types of bonds.
To know the different types of equilibrium and be able to calculate the concentrations and pressures in a chemical process in equilibrium.
To know the basic concepts and principles of Chemistry,
To know the nomenclature and terminology used in chemistry.

Additional outcomes

-Acquire general knowledge of Chemistry that will allow learning other subjects within the area of ¿¿chemistry and chemical engineering. -Through the resolution of the seminar sheets and the practical cases raised, be able to evaluate and analyze a problem and select the most appropriate method for its resolution among those proposed in the theory. -Develop the ability to work as a team through work during classes, seminars and the work developed in laboratory sessions. -Acquire knowledge about the fundamentals of Chemistry: the different states of matter, its structure, chemical bond, equilibrium... Know how to apply said knowledge to the different fields of chemistry as well as its applications in engineering by solving practical cases and exercises. -In the laboratory sessions, use the basic laboratory instruments to carry out basic processes in a chemistry laboratory: preparation of solutions, titration, distillation, batteries... -During the practical sessions in the laboratory, learn to handle adequately both the material and the different chemical products, interpreting the risks associated with the use of chemical substances. In addition, acquire knowledge about the treatment of waste generated in it.

6. Units / Contents

Unit 1: ATOMIC STRUCTURE. From classical physics to quantum theory. Bohr's theory of the hydrogen atom. The dual nature of the electron. Quantum mechanics. The quantum numbers. Atomic orbitals.

Unit 2: MOLECULAR STRUCTURE: COVALENT LINK. Electronegativity. Introduction to the chemical bond. Lewis structures. valence bond theory Hybridization. Molecular orbital theory.

Unit 3: STATES OF AGGREGATION. Gas laws. Gas mixtures. Kinetic theory of gases. Real gases. intermolecular forces. Phase diagrams. Properties of liquids. Crystal structure of ionic solids. Ionic radii. Grid power. Types of crystalline solids.

Unit 4: SOLUTIONS. Types of dissolution. Concentration. Solubility. Pressure. Colligative properties. colloidal mixtures.

Unit 5: ACID-BASE EQUILIBRIUM. Bronsted and Lowry theory. Strength of acids and bases. Ionic product of water: pH. Calculation of pH in solutions of acids and bases. Hydrolysis. Calculation of pH in salt solutions. buffer solutions or buffers. Acid-base titrations.

Unit 6: PRECIPITATION EQUILIBRIUM. Solubility and solubility product. Beginning and end of precipitation. fractional precipitation. Common ion effect.

Unit 7: REDOX EQUILIBRIUM. General principles of oxidation-reduction. Adjustment of oxidation-reduction reactions. Oxidizing and reducing agents. electrochemical cells. Standard electrode potentials. Nernst equation.

Unit 8: LABORATORY PRACTICES: INITIATION TO THE CHEMISTRY LABORATORY. Laboratory safety. The laboratory notebook. Lab's material. Preparation of solutions. Ratings. Chemical balance. Distillation. voltaic pile.

ADDITIONAL COMMENTS, REMARKS

Topics 1 to 7 will be taught by Dr. Yolanda Díaz de Mera Morales.

Laboratory practices (item 8) will be taught by Dr. Alberto Notario Molina and Dr. Yolanda Díaz de Mera Morales.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Self-study [OFF-SITE]	Self-study	G20 G21	1	25	N	-	AUTONOMOUS AND PERSONAL WORK OF THE STUDENT: BEFORE, DURING AND AFTER the face-to-face classes, to study and assimilate the theoretical and practical concepts that will be addressed in the classes.
Class Attendance (theory) [ON-SITE]	Combination of methods	E04 G03 G20	1.36	34	N	-	Face-to-face teaching where the theoretical and practical concepts of the subject will be worked on and examples will be solved that allow understanding the explained concepts. The student will be provided with all the DIDACTIC MATERIAL to follow the subject. The methodology will be ACTIVE with participatory classes through different methodologies: peer discussion, problem solving, group work,... The student will attend face-to-face classes HAVING PREVIOUSLY STUDIED the subject matter.
Progress test [ON-SITE]	Assessment tests		0.04	1	Y	N	Carrying out a mini-exam so that the student can check her progress in the subject. It is part of the continuous evaluation.
Workshops or seminars [ON-SITE]	Problem solving and exercises	CB02 CB03 CB04 CB05 E04 G03 G14 G18 G20 G21 G22	0.28	7	Y	N	Different activities will be planned that involve discussion, analysis, resolution,... by the students, individually or in groups, of exercises, problems, activities or practical cases. It is part of the continuous evaluation.
							Previous study and completion of previous online questionnaires

Self-study [OFF-SITE]	Self-study		0.28	7	Y	N	before starting each topic so that the student can check their initial understanding of the topic. It is part of the continuous evaluation.
Other off-site activity [OFF-SITE]	Self-study		0.16	4	Y	N	To work with the PeerWise tool. It is part of the continuous evaluation.
Study and Exam Preparation [OFF-SITE]	Problem solving and exercises	G03 G20 G21	1.51	37.75	N	-	Resolution of the exercises proposed by the teacher.
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E04 E25 G03 G20 G21	0.64	16	Y	Y	The student will be introduced to the handling of chemical substances, techniques and basic laboratory material, taking into account safety standards.
Other off-site activity [OFF-SITE]	Practical or hands-on activities	G21	0.41	10.25	N	-	Before the beginning of the practical sessions, students will be provided with the corresponding practice scripts. Before attending the corresponding session in the laboratory, YOU MUST HAVE READ AND UNDERSTOOD the methodology that will be followed in practice.
Final test [ON-SITE]	Assessment tests	E04 G03 G14 G18 G20 G21 G22	0.08	2	Y	Y	Carry out a written test to evaluate the learning of the contents taught in the classes and seminars.
Study and Exam Preparation [OFF-SITE]	Self-study	G20 G21	0.24	6	N	-	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.6					**Total hours of out of class work: 90**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Other methods of assessment	25.00%	0.00%	CONTINUOUS ASSESSMENT of learning through different proposals: previous questionnaires (6%), seminars (7%), PeerWise (6%), mini-exam (6%). All the information necessary to obtain this grade will be provided at the beginning of the course.
Laboratory sessions	15.00%	15.00%	Compulsory and active performance of laboratory practices. Evaluation: Previous questionnaires (2/10 points), dexterity (1/10 points), practical test (preparation of a solution (3/10 points) and practical exam (4/10 points)).
Final test	60.00%	85.00%	Completion of a compulsory written test (theory (4/10) and problems (6/10)) to evaluate the learning of the contents taught in the subject.
Test	0.00%	0.00%	Pass a mandatory inorganic formulation exam in which only 2/10 failures will be accepted when naming and 2/10 failures when formulating the compounds.
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The student will take into account the following clarifications:
-The final mark of the subject will be obtained taking into account the percentages shown in 'assessment system'
-To make an average, the grade in the final exam and in the practices must be at least 4/10
-To pass the subject, the global average must be equal to or greater than 5/10
-Passing the formulation exam is mandatory to pass the subject
-Attendance at theoretical classes and seminars is not mandatory
-Attendance at laboratory sessions is mandatory

Non-continuous evaluation:

Those students who report that they cannot follow the continuous assessment (and meet the established requirements), will be entitled to a final test where all the skills corresponding to the continuous assessment and the final exam (85% of the total grade) will be evaluated.
-To make an average, the grade in the final test and in the practices must be at least 4/10
-To pass the subject, the global average must be equal to or greater than 5/10

Specifications for the resit/retake exam:

Particularities of the extraordinary call:
-In the extraordinary call, the weight of each of the parts in the final mark will be the same as in the ordinary call: continuous evaluation, 25%; laboratory, 15%; exam, 60%. The qualifications of the continuous evaluation and of the laboratory practices will be kept.
Only those students with more than 4/10 in the exam and with the APTO formulation can make an average to pass the subject.

Test
On the date officially announced on the website of the faculty, an exam will be held for all students who have not passed 4/10 in this part in the ordinary call or for those who, having passed it, want to raise their grade.
On the same day, an inorganic formulation test will be carried out.

Formulation
On the same day and at the same time as the final exam, an inorganic formulation exam will be held for those students who need to pass it.

Specifications for the second resit / retake exam:

The same methodology will be followed as for the extraordinary call.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**
Unit 1 (de 8): ATOMIC STRUCTURE. From classical physics to quantum theory. Bohr's theory of the hydrogen atom. The dual nature of the electron. Quantum mechanics. The quantum numbers. Atomic orbitals.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	4
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Final test [PRESENCIAL][Assessment tests]	.3
Unit 2 (de 8): MOLECULAR STRUCTURE: COVALENT LINK. Electronegativity. Introduction to the chemical bond. Lewis structures. valence bond theory Hybridization. Molecular orbital theory.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	6
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Final test [PRESENCIAL][Assessment tests]	.3
Unit 3 (de 8): STATES OF AGGREGATION. Gas laws. Gas mixtures. Kinetic theory of gases. Real gases. intermolecular forces. Phase diagrams. Properties of liquids. Crystal structure of ionic solids. Ionic radii. Grid power. Types of crystalline solids.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	6
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Final test [PRESENCIAL][Assessment tests]	.28
Unit 4 (de 8): SOLUTIONS. Types of dissolution. Concentration. Solubility. Pressure. Colligative properties. colloidal mixtures.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	3
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Final test [PRESENCIAL][Assessment tests]	.28
Unit 5 (de 8): ACID-BASE EQUILIBRIUM. Bronsted and Lowry theory. Strength of acids and bases. Ionic product of water: pH. Calculation of pH in solutions of acids and bases. Hydrolysis. Calculation of pH in salt solutions. buffer solutions or buffers. Acid-base titrations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	7
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Final test [PRESENCIAL][Assessment tests]	.28
Unit 6 (de 8): PRECIPITATION EQUILIBRIUM. Solubility and solubility product. Beginning and end of precipitation. fractional precipitation. Common ion effect.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	5
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Final test [PRESENCIAL][Assessment tests]	.28
Unit 7 (de 8): REDOX EQUILIBRIUM. General principles of oxidation-reduction. Adjustment of oxidation-reduction reactions. Oxidizing and reducing agents. electrochemical cells. Standard electrode potentials. Nernst equation.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	4
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Final test [PRESENCIAL][Assessment tests]	.28
Unit 8 (de 8): LABORATORY PRACTICES: INITIATION TO THE CHEMISTRY LABORATORY. Laboratory safety. The laboratory notebook. Lab's material. Preparation of solutions. Ratings. Chemical balance. Distillation. voltaic pile.	
Activities	**Hours**
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	16
Global activity	
Activities	**hours**
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	7
Class Attendance (theory) [PRESENCIAL][Combination of methods]	35
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	16
Final test [PRESENCIAL][Assessment tests]	2
Total horas:	60

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Domínguez Reboiras, Miguel		Thomson				

Ángel	Química : la ciencia básica	Paraninfo	978-84-9732-347-5	2008	
Peterson, W. R.	Introducción a la nomenclatura de las sustancias químicas	Reverté	978-84-291-7572-1	2010	
Ralph H. Petrucci et al.	General Chemistry: Principles and Modern Applications	Pearson-Prentice Hall		2017	11th edition
Brown et al.	Chemistry: The Central Science (MasteringChemistry)	Pearson Educación		2017	14th edition
Ignacio Escudero Molina	Introducción a la nomenclatura química inorgánica según las recomendaciones de la UIPAC	Editorial Club Universitario	978-84-17924-04-1	2019	