UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: INORGANIC CHEMISTRY II
Type: CORE COURSE
Degree: 409 - CHEMISTRY
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Year: 2
Main language: Spanish
Use of additional languages:
Web site:

Code: 57313
ECTS credits: 6
Academic year: 2023-24
Group(s): 20 23
Duration: C2
Second language: English
English Friendly: Y
Bilingual: N

Lecturer: **FERNANDO CARRILLO HERMOSILLA** - Group(s): **23**

Building/Office	Department	Phone number	Email	Office hours
SAN ALBERTO MAGNO	QUÍMICA INORG., ORG., Y BIOQ.	3417	fernando.carrillo@uclm.es	Monday, Tuesday and Wednesday, from 13:00 to 14:00.

Lecturer: **Mª ISABEL LOPEZ SOLERA** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.	926052501	mabel.lopez@uclm.es	Monday and Wednesday, 17 - 18.30 h. Tuesday and Thursday, 12 - 13.30 h.

2. Pre-Requisites

They have not been established, although it is convenient to have passed the course CHEMISTRY, in the first year, and to take, at the same time, the course Inorganic Chemistry I, in the second year. It is advisable that the student be familiar with the theories of chemical bonding, acid-base, redox and formulation in Inorganic Chemistry.

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

The course is located in the second semester of the second year of the Degree in Chemistry and belongs to the Fundamentals of Chemistry Module (Inorganic Chemistry matter). Its character is obligatory. The student will learn the structure, the reactivity and the preparation (from laboratory and industrial) of the elements and the inorganic compounds of the transition and f-blockmetals of the periodic table. This knowledge is essential to understand the properties and practical applications of these substances and their impact on current applied chemistry. The acquisition of this knowledge is important for studying the course Inorganic Compounds (3rd course), as well as other related courses in higher education.

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.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
E01	Understand and use chemical terminology, nomenclature, conventions and units
E02	Deduce the variation of the properties of the chemical elements according to the Periodic Table
E05	Know the chemical elements and their compounds, their forms of obtaining, structure, properties and reactivity, as well as the main techniques for their analysis
E07	Relate macroscopic properties with those of atoms, molecules and non-molecular chemical compounds
G01	Know the principles and theories of Chemistry, as well as the methodologies and applications characteristic of analytical chemistry, physical chemistry, inorganic chemistry and organic chemistry, understanding the physical and mathematical bases that require
T03	Proper oral and written communication
T04	Ethical commitment and professional ethics
T05	Organization and planning capacity
T07	Ability to work as a team and, where appropriate, exercise leadership functions, fostering the entrepreneurial character
T08	Skills in interpersonal relationships
T11	Ability to obtain bibliographic information, including Internet resources

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Know the main methods of preparing inorganic compounds.

Know systematically the main families of inorganic compounds and their reactivity.

Know the main properties of inorganic compounds and relate them to structural aspects.

Know the aspects of obtaining, structural, stability and reactivity of the elements.

To develop in the student the capacity of initiative to pose and solve specific problems of Chemistry, as well as to interpret the obtained results.

Develop in the student the ability to synthesize, being critical and objective

Develop in the student the ability to work in a team.
Encourage and promote in the student all those values ¿¿and attitudes inherent to scientific activity.
Know the fundamental concepts of Inorganic Chemistry.
Know the most important theoretical principles of chemical bonding in inorganic compounds
Train the student for autonomous work and learning, as well as for personal initiative.
Train the student to search for information, its analysis, interpretation and use for practical purposes.

6. Units / Contents

Unit 1: Introduction to the transition elements of block d. The metals. Definition of transition metal. General properties of the transition elements: analogies and differences between the elements of the three transition series Stability trends of the different oxidation states. General chemical properties.

Unit 2: Metallurgy. Metals in Nature. Preparation of the ore. Metal production. Iron metallurgy. Steel manufacture. Metal purification.

Unit 3: Coordination compounds. General concepts: coordination complexes, ligands, number and coordination sphere. Symmetry in complexes. Isomerism. Bonding theories: crystalline field theory and molecular orbital theory Electronic configurations: high and low spin complexes Crystal field stabilization energy. Magnetism in coordination compounds. Jahn-Teller effect and chelate effect. Coordination polymers and supramolecular aggregates

Unit 4: Group 4 elements. Titanium, zirconium and hafnium. General properties. Obtention and applications. Significant combinations.

Unit 5: Group 5 elements. Vanadium, niobium and tantalum. General properties. Obtention and applications. Significant combinations.

Unit 6: Group 6 elements. Chrome, molybdenum and tungsten. General properties. Obtention and applications. Significant combinations.

Unit 7: Group 7 elements. Manganese, technetium and rhenium. General properties. Production and applications. Significant combinations.

Unit 8: Group 8 elements. Iron, ruthenium and osmium. General properties. Obtaining and applications. Significant combinations.

Unit 9: Group 9 elements. Cobalt, rhodium and iridium. General properties. Obtaining and applications. Significant combinations.

Unit 10: Group 10 elements. Nickel, palladium and platinum. General properties. Obtaining and applications. Significant combinations.

Unit 11: Group 11 elements. Copper, silver and gold. General properties. Obtaining and applications. Significant combinations.

Unit 12: Scandium, yttrium, lanthanum and lanthanide elements General properties of the elements. Separation and obtaining of the elements. Applications. Combinations of the elements of the group.

Unit 13: Actinium and actinide elements. General properties of the elements. Separation and obtaining of the elements. Applications. Combinations of the elements of the group.

Unit 14: Introduction to homogeneous and heterogeneous catalysis. Preliminary concepts. Industrial applications of homogeneous catalysis. Industrial applications of heterogeneous catalysis.

Unit 15: Biological aspects of metals. Introduction. Bioinorganic compounds of interest.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Other Methodologies	E01 E02 E05 E07 G01	1.44	36	N	-	The fundamental aspects of the subject will be explained in class, accompanied by illustrative examples. The student will be provided with the necessary didactic material to follow the subject, with the help of the web and the Campus Virtual platform.
Workshops or seminars [ON-SITE]	Problem solving and exercises	E01 E02 E05 E07 G01 T07 T11	0.68	17	Y	N	Model questions and problems will be solved to provide the student with a complete understanding of the subject. Individual and group work will be done.
Study and Exam Preparation [OFF-SITE]	Self-study	E01 E02 E05 E07 G01 T11	3.72	93	N	-	It is important for the correct learning of the subject, that the student works on his own, simultaneously and continuously, everything that has been worked on in the classroom training activities.
Group tutoring sessions [ON-SITE]	Group tutoring sessions	E01 E02 E05 E07 G01	0.08	2	Y	N	Questions prior to continuous evaluations will be resolved, and learning will be monitored.
Mid-term test [ON-SITE]	Assessment tests	E01 E02 E05 E07 G01	0.08	2	Y	N	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.28					**Total class time hours: 57**
		Total credits of out of class work: 3.72					**Total hours of out of class work: 93**

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
Final test	0.00%	100.00%	Comprehensive examination of the course
Assessment of problem solving and/or case studies	25.00%	0.00%	The active participation of the student in the seminars will be valued positively. At the suggestion of the teacher, the problems or questions proposed may be submitted for

			assessment.
Mid-term tests	70.00%	0.00%	They are obligatory to pass the continuous evaluation, in which the student must demonstrate that he has acquired the corresponding knowledge.
Other methods of assessment	5.00%	0.00%	Active participation in group tutoring will be evaluated.
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:

Continuous evaluation means participating in all evaluation activities. The student will pass the course with a minimum grade of 5.

There will be two progress tests that must be passed with a grade higher than 40% to be able to average with the rest of the evaluation activities. If a student has not passed the first progress test, he or she must make up the test in the ordinary call, in order to pass the course. The second progress test will be carried out in the ordinary call.

Non-continuous evaluation:

Students who do not follow the continuous assessment will take only one exam in the ordinary call referring to the total of the subject, which must be passed by obtaining a grade equal to or higher than 5.

Specifications for the resit/retake exam:

The same criteria will be used as in the ordinary evaluation. The student who has followed the continuous assessment will only have to examine the progress tests not passed with a grade equal to or greater than 5 points.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Study and Exam Preparation [AUTÓNOMA][Self-study]	13.5
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	2
Mid-term test [PRESENCIAL][Assessment tests]	2
Unit 1 (de 15): Introduction to the transition elements of block d. The metals. Definition of transition metal. General properties of the transition elements: analogies and differences between the elements of the three transition series Stability trends of the different oxidation states. General chemical properties.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	5
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	9
Unit 2 (de 15): Metallurgy. Metals in Nature. Preparation of the ore. Metal production. Iron metallurgy. Steel manufacture. Metal purification.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	2
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	4.5
Unit 3 (de 15): Coordination compounds. General concepts: coordination complexes, ligands, number and coordination sphere. Symmetry in complexes. Isomerism. Bonding theories: crystalline field theory and molecular orbital theory Electronic configurations: high and low spin complexes Crystal field stabilization energy. Magnetism in coordination compounds. Jahn-Teller effect and chelate effect. Coordination polymers and supramolecular aggregates	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	12
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	27
Unit 4 (de 15): Group 4 elements. Titanium, zirconium and hafnium. General properties. Obtention and applications. Significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 5 (de 15): Group 5 elements. Vanadium, niobium and tantalum. General properties. Obtention and applications. Significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 6 (de 15): Group 6 elements. Chrome, molybdenum and tungsten. General properties. Obtention and applications. Significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 7 (de 15): Group 7 elements. Manganese, technetium and rhenium. General properties. Production and applications. Significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 8 (de 15): Group 8 elements. Iron, ruthenium and osmium. General properties. Obtaining and applications. Significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 9 (de 15): Group 9 elements. Cobalt, rhodium and iridium. General properties. Obtaining and applications. Significant combinations.	
Activities	**Hours**

Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 10 (de 15): Group 10 elements. Nickel, palladium and platinum. General properties. Obtaining and applications. Significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 11 (de 15): Group 11 elements. Copper, silver and gold. General properties. Obtaining and applications. Significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	10.5
Unit 12 (de 15): Scandium, yttrium, lanthanum and lanthanide elements General properties of the elements. Separation and obtaining of the elements. Applications. Combinations of the elements of the group.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5
Unit 13 (de 15): Actinium and actinide elements. General properties of the elements. Separation and obtaining of the elements. Applications. Combinations of the elements of the group.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	1
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	4.5
Unit 14 (de 15): Introduction to homogeneous and heterogeneous catalysis. Preliminary concepts. Industrial applications of homogeneous catalysis. Industrial applications of heterogeneous catalysis.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	4
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	7.5
Unit 15 (de 15): Biological aspects of metals. Introduction. Bioinorganic compounds of interest.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	4.5
Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Other Methodologies]	36
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	17
Study and Exam Preparation [AUTÓNOMA][Self-study]	93
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	2
Mid-term test [PRESENCIAL][Assessment tests]	2
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
COTTON, F. Albert	Advanced inorganic chemistry	John Wiley and Sons		0-471-84997-9	1988	
Greenwood, N. N.	Chemistry of the elements	Butterworth-Heinemann		978-0-7506-3365-9	2008	
Shriver, Duward F.	Química inorgánica	Reverté		84-291-7006-5	2004	
COTTON, F. Albert	Química inorgánica avanzada	Limusa		968-18-0052-4	1994	
Housecroft, Catherine E.	Química inorgánica	Pearson/Prentice Hall		978-84-205-4847-0	2006	
Beyer, Lothar	Química inorgánica	Ariel		84-344-8027-1	2000	