UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: INORGANIC CHEMISTRY
Code: 57709
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: 2
Duration: First semester
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **FERNANDO CARRILLO HERMOSILLA** - Group(s): **21**

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: **GEMA DURA GRACIA** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.		Gema.Dura@uclm.es	Monday, Tuesday and Wednesday, from 13:00 to 14:00.

Lecturer: **SANTIAGO GARCIA YUSTE** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.	3477	santiago.gyuste@uclm.es	Monday, Tuesday and Wednesday, from 13:00 to 14:00.

Lecturer: **AGUSTIN LARA SANCHEZ** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	3499	agustin.lara@uclm.es	Monday, Tuesday and Wednesday, from 13:00 to 14:00.

2. Pre-Requisites

No prerequisites have been established, although it is recommended to have passed the subject of Fundamentals of Chemistry in the first year.

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

The training received by students of Inorganic Chemistry is essential for the understanding, understanding, design and development of the most important industrial processes in the Chemical Industry. Most of the processes in the chemical industry are related to inorganic compounds such as water treatment, construction materials, polymeric materials, fertilizers, dyes, basic chemicals (H_2SO_4, NH_3, NaOH, HNO_3 etc), new materials (fibers, alloys, nanomaterials, etc), fuel cells, explosives…. The Inorganic Chemistry course is essential for the training of a Chemical Engineer and is practically related to all degree subjects, although we can cite: Separation Operations Chemical, Reaction Engineering Environmental, Technology Materials in Chemical, Engineering Electrotechnics and Electronics, Integrated Laboratory of Basic Operations and Chemical Reaction, Engineering Instrumentation and Control of Chemical Processes, Biochemical Engineering Process and Product Engineering Coal, Oil and Petrochemistry Basic Operations of the Food and Pharmaceutical Industry Risk Analysis, Safety and Occupational Health in the Chemical Industry Renewable Energies and Energy Evaluation of Chemical Processes

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 know how to apply the knowledge of Organic Chemistry to the solution of synthetic and structural problems.
To develop your ability to work in a team.
To master stoichiometric adjustment, calculation of concentrations and systems and conversion of units.
To learn to elaborate topics and acquire skills in oral and written presentation at the time of the presentation of results.
To know all those values and attitudes inherent in scientific activity.
To know systematically the main families of inorganic compounds and their reactivity.
To know the main methods of inorganic compounds preparation.
To know the different types of bonds.
To understand the importance of organic products in the chemical industry and in everyday life.
To know the main properties of inorganic compounds and relate them to structural aspects.
To know the main aspects of terminology and nomenclature in Organic Chemistry.
To know the fundamental concepts of Inorganic Chemistry and the periodic system.
To know the basic concepts and principles of Chemistry,
To know the nomenclature and terminology used in chemistry.
To know the stereochemistry of organic compounds and the stereoselectivity of the main reactions.

6. Units / Contents

Unit 1: Introduction. The elements. The Periodic Table. General trends in oxides and halides. Reduction-oxidation processes. Acid-base theories.

Unit 2: Noble gases. Obtaining, uses and properties of the noble gases.

Unit 3: Hydrogen. Hydrogen isotopes. Production. Storage. Hydrogen as an energy carrier.

Unit 4: Halogens. Obtaining the elements. Hydrogen halides. Oxoacids of the halogens. Uses of halides.

Unit 5: Oxygen. Water. Peroxides.

Unit 6: Sulphur. Sulphuric acid production. Other sulphur derivatives.

Unit 7: Nitrogen. Nitrogen oxides and atmospheric pollution. Ammonia synthesis. Production of nitric acid and urea.

Unit 8: Phosphorus. Phosphoric acid and phosphates.

Unit 9: Carbon. Allotropic forms. Carbon oxides.

Unit 10: Silicon. Silicates. Organosilanes.

Unit 11: Introduction to metallic elements and metallurgy. Bonding in metals. Conductors and semiconductors. Metals in nature. Production of metals. Metallurgy of iron. Steel manufacture. Purification of metals. Corrosion.

Unit 12: Main group metals. Lithium, sodium and potassium. Lithium-ion batteries. Aluminum. Production, recycling and chemistry in aqueous solution. Tin and lead. Bronze. Lead batteries. Zinc and mercury. Alloys. Toxicity of mercury.

Unit 13: Transition metals. Properties of transition metals. Electronic configurations. Variation in general physical properties: melting and boiling points, atomic radii and density. Variation of chemical properties: ionisation potentials, electronegativity and standard reduction potentials. Relative stability of different oxidation states. Metals of the first series. Obtaining, properties and significant combinations.

Unit 14: Laboratory practice: Synthesis and reactivity of inorganic derivatives.

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]	Lectures	CB02 CB03 CB05 E04 G03 G18 G21 G22	1.2	30	N	-	
Problem solving and/or case studies [ON-SITE]	Project/Problem Based Learning (PBL)	CB02 CB03 CB04 CB05 E04 G03 G14 G18 G20 G21 G22	0.4	10	Y	N	
Group tutoring sessions [ON-SITE]	Group tutoring sessions	G14 G18 G20 G21	0.04	1	N	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E04 E25 G03 G14 G18 G20 G21 G22	0.8	20	Y	Y	
Mid-term test [ON-SITE]	Assessment tests	CB02 CB03 CB04 CB05 E04 E25 G03 G14 G18 G20 G21 G22	0.06	1.5	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CB02 CB03 CB05 E04 G18 G20 G21 G22	3.5	87.5	N	-	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.5					**Total class time hours: 62.5**
		Total credits of out of class work: 3.5					**Total hours of out of class work: 87.5**

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	Non-continuous	Description

	assessment	evaluation*	
Mid-term tests	70.00%	0.00%	
Laboratory sessions	10.00%	10.00%	
Assessment of problem solving and/or case studies	20.00%	0.00%	
Final test	0.00%	90.00%	
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 involves taking part in all the evaluation activities. The course will be considered passed when the overall grade is higher than 5. There will be two partial exams that must be passed with a grade of over 40% in order to be able to average with the rest of the training activities. If the first one is not passed, it may be made up on the date of the ordinary exam. The second test will be held on the same date.

Non-continuous evaluation:

Students who do not follow the continuous evaluation will take a single exam in the ordinary exam session referring to the total of the course, which must be passed by obtaining a grade equal to or higher than 5. The final grade will take into account this exam and the completion of the laboratory practices.

Specifications for the resit/retake exam:

The same criteria will be used as in the ordinary evaluation. Students who have followed the continuous assessment will only have to take the exams of the partial exams not passed with a grade equal to or higher than 5 points.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
Mid-term test [PRESENCIAL][Assessment tests]	1.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	87.5

Unit 1 (de 14): Introduction. The elements. The Periodic Table. General trends in oxides and halides. Reduction-oxidation processes. Acid-base theories.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2

Group 21:

Initial date: 05-09-2022 **End date:**

Unit 2 (de 14): Noble gases. Obtaining, uses and properties of the noble gases.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1

Unit 3 (de 14): Hydrogen. Hydrogen isotopes. Production. Storage. Hydrogen as an energy carrier.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1

Unit 4 (de 14): Halogens. Obtaining the elements. Hydrogen halides. Oxoacids of the halogens. Uses of halides.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2

Unit 5 (de 14): Oxygen. Water. Peroxides.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2

Unit 6 (de 14): Sulphur. Sulphuric acid production. Other sulphur derivatives.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2

Unit 7 (de 14): Nitrogen. Nitrogen oxides and atmospheric pollution. Ammonia synthesis. Production of nitric acid and urea.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3

Unit 8 (de 14): Phosphorus. Phosphoric acid and phosphates.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2

Unit 9 (de 14): Carbon. Allotropic forms. Carbon oxides.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2

Unit 10 (de 14): Silicon. Silicates. Organosilanes.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2

Unit 11 (de 14): Introduction to metallic elements and metallurgy. Bonding in metals. Conductors and semiconductors. Metals in nature. Production of metals. Metallurgy of iron. Steel manufacture. Purification of metals. Corrosion.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1

Unit 12 (de 14): Main group metals. Lithium, sodium and potassium. Lithium-ion batteries. Aluminum. Production, recycling and chemistry in aqueous solution. Tin and lead. Bronze. Lead batteries. Zinc and mercury. Alloys. Toxicity of mercury.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Unit 13 (de 14): Transition metals. Properties of transition metals. Electronic configurations. Variation in general physical properties: melting and boiling points, atomic radii and density. Variation of chemical properties: ionisation potentials, electronegativity and standard reduction potentials. Relative stability of different oxidation states. Metals of the first series. Obtaining, properties and significant combinations.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Unit 14 (de 14): Laboratory practice: Synthesis and reactivity of inorganic derivatives.	
Activities	**Hours**
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Group 21:	
Initial date:	**End date:** 22-12-2022
Global activity	
Activities	**hours**
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	10
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
Mid-term test [PRESENCIAL][Assessment tests]	1.5
Class Attendance (theory) [PRESENCIAL][Lectures]	30
Study and Exam Preparation [AUTÓNOMA][Self-study]	87.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Petrucci, Ralph H.	General chemistry: principles and modern applications	Prentice Hall		0-13-014329-4	2002	
Housecroft, Catherine E.	Inorganic chemistry	Prentice Hall		0-582-31080-6	2001	
	Industrial inorganic chemistry	VCH		3527266291	1989	
Shriver, Duward F.	Inorganic chemistry	Oxford University Press		0-19-926463-5	2006	