



1. General information

Course: MOLECULAR INORGANIC CHEMISTRY

Type: CORE COURSE

Degree: 409 - CHEMISTRY

Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY

Year: 3

Main language: Spanish

Use of additional languages:

Web site:

Code: 57317

ECTS credits: 6

Academic year: 2023-24

Group(s): 20 23

Duration: First semester

Second language: English

English Friendly: Y

Bilingual: N

Lecturer: GEMA DURA GRACIA - Group(s): 20 23				
Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.		Gema.Dura@uclm.es	Monday and Wednesday from 5:00 p.m. to 6:00 p.m.
Lecturer: SANTIAGO GARCIA YUSTE - Group(s): 20 23				
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 and Wednesday from 5:00 p.m. to 6:00 p.m.
Lecturer: AGUSTIN LARA SANCHEZ - Group(s): 20 23				
Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	3499	agustin.lara@uclm.es	Tuesday and Thursday from 17:00 to 18:00 h.
Lecturer: ELENA VILLASEÑOR CAMACHO - Group(s): 20 23				
Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.	926052133	elena.villasenor@uclm.es	Tuesday and Thursday from 17:00 to 18:00 h.

2. Pre-Requisites

It is recommended that you have completed and approved the subject of Inorganic Chemistry

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

This subject is part of the subject Inorganic Compounds along with the subject Inorganic Chemistry of the Solid State that is taught in the second semester within the Modules of Chemistry.

The course is the basis for understanding inorganic compounds with molecular structures such as coordination compounds and organometallic compounds. These compounds are of special importance for the understanding of many catalytic processes of industrial interest where they act as catalysts such as olefin metathesis processes, hydrogenation of unsaturated substrates, carbonylation... In addition, the pharmaceutical industry and a molecule of special importance for living beings. Alive are compounds of this type such as hemoglobin, chlorophyll... This warns us of the importance of the subject for the formation of a Chemist, since most chemical reactions involve inorganic molecular compounds.

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.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
E03	Handle chemicals safely and with respect to the environment
E06	Know the structural properties of chemical compounds, including stereochemistry, as well as the main structural research techniques
E07	Relate macroscopic properties with those of atoms, molecules and non-molecular chemical compounds
E09	Know the kinetics of chemical change, including catalysis and reaction mechanisms
E15	Know how to handle the standard chemical instrumentation and be able to elaborate and manage standardized procedures of work in the laboratory and chemical industry
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
G02	Be able to gather and interpret data, information and relevant results, obtain conclusions and issue reasoned reports on scientific, technological or other problems that require the use of chemical tools
G03	Know how to apply the theoretical-practical knowledge acquired in the different professional contexts of Chemistry
T05	Organization and planning capacity
T07	Ability to work as a team and, where appropriate, exercise leadership functions, fostering the entrepreneurial character
T10	Ability to use specific software for chemistry at user level

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Apply and interpret some techniques of structural determination or study of properties of molecular and solid inorganic compounds

Apply advanced techniques of preparation of molecular and solid inorganic compounds.

Know fundamental aspects of thermodynamic and kinetic type of complexes and organometallic compounds

Know systematically the main families of organometallic compounds and their reactivity

Know the fundamental concepts of Coordination Chemistry and Organometallic Chemistry.

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: Fundamental concepts in coordination chemistry

Unit 2: Thermodynamic and kinetic in coordination compounds

Unit 2.1 Thermodynamic factors in coordination chemistry

Unit 2.2 Types of reactions and reaction mechanisms

Unit 3: Basics Organometallic Chemistry.

Unit 3.1 Classification of organometallic compounds.

Unit 3.2 General stability of organometallic compounds.

Unit 3.3 Types of ligands.

Unit 3.4 Effective atomic number rule

Unit 4: Types of reactivity in organometallic compounds.

Unit 5: Synthesis, structure and properties of organometallic compounds.

Unit 6: Laboratory work.

Unit 6.1 Synthesis and structural characterization of [CoH(POPh₃)₃]

Unit 6.2 Preparation, structural characterization and use of ferrocene

Unit 6.3 Síntesis y resolución de los isómeros ópticos de un catión complejo

Unit 6.4 Síntesis y caracterización estructural de acetato de cobre

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]	Combination of methods	E06 E07 G01 G03	1.2	30	N	-	Master lessons and case resolution
Class Attendance (practical) [ON-SITE]	Combination of methods	E03 E15 G03 T05	0.8	20	Y	Y	Realization of experiences lab practices and discussion with the teacher
Problem solving and/or case studies [ON-SITE]		G02 G03 T10 T11	0.2	5	Y	N	Resolution and discussion of exercises and problems
Study and Exam Preparation [OFF-SITE]		E06 E07 E15 G01 G02 G03	1.2	30	N	-	
Writing of reports or projects [OFF-SITE]	Self-study	G03 T05 T07 T10 T11	1.2	30	N	-	Documentation, preparation learning and case resolution practical
Other off-site activity [OFF-SITE]		E06 E07 E15 G01 G02 G03	1.2	30	N	-	Consolidation by study of the subjects of the subject
Final test [ON-SITE]	Assessment tests	E06 E07 E15 G01 G02 G03	0.08	2	Y	Y	
Group tutoring sessions [ON-SITE]	Group tutoring sessions	CB02 CB04 E03 E06 E07 E09 E15 G01 G02 G03 T05 T07 T10 T11	0.08	2	N	-	Resolution of doubts, follow-ups of teaching activity and resolution of academic problems of the subject.
Mid-term test [ON-SITE]	Assessment tests	CB02 CB04 E03 E06 E07 E09 E15 G01 G02 G03 T05 T07 T10 T11	0.04	1	Y	Y	
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
Final test	70.00%	80.00%	70% corresponds to the exams carried out in the partial and final test, that is to say, to the qualification obtained in these tests.
Laboratory sessions	20.00%	20.00%	Continuous evaluation through the follow-up of the acquisition of practical knowledge (laboratory) and the evaluation of the notebook laboratory that will include the answers to different

			questions raised. Carrying out a test on the contents of the practices
Assessment of problem solving and/or case studies	10.00%	0.00%	Resolution of practical cases in the classroom, which demonstrate the acquisition of competencies corresponding. It will be added to the first section.
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 final qualification will be the result of a continuous evaluation through the follow-up of the acquisition of theoretical and practical knowledge that demonstrates the acquisition of the corresponding competences.

At the end of the first part of the subject (Chemistry of Coordination) there will be a progress test, which if passed (5 points or more) will serve as part of the final exam grade.

There will be seminars or problems that must be delivered to the teacher and will be solved in class.

The laboratory practices are mandatory and to pass the subject the final practical grade must be greater than or equal to 5 points out of 10. This grade is made up of the work in the laboratory and a theoretical test on the concepts worked on in the laboratory.

The final grade for the course will be calculated as a result of the following actions:

a) final exam (70% of the grade), b) practicals (laboratory) (20% of the grade) and c) resolution of practical cases (10% of the grade).

It will not be possible to pass the subject if the practices have not been carried out and approved and if the final exam is not passed.

Non-continuous evaluation:

Final numerical score from 0 to 10 depending on current legislation.

The final qualification will be the result of an evaluation that demonstrates the acquisition of the corresponding competences.

The laboratory practices are mandatory and to pass the subject the final practical grade must be greater than or equal to 5 points out of 10.

The final grade for the course will be calculated as a result of the following actions:

a) final exam (80% of the grade) and b) practicals (laboratory) (20% of the grade).

It will not be possible to pass the subject if the practices have not been carried out and approved and if the final exam is not passed.

Specifications for the resit/retake exam:

The qualification will be the one obtained in the test of the extraordinary call where all the contents and competences acquired in the subject will be evaluated; theoretical part, problems, seminars and practices.

Specifications for the second resit / retake exam:

The qualification will be the one obtained in the test of the extraordinary call where all the contents and competences acquired in the subject will be evaluated; theoretical part, problems, seminars and practices.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	30
Class Attendance (practical) [PRESENCIAL][Combination of methods]	20
Problem solving and/or case studies [PRESENCIAL][]	5
Study and Exam Preparation [AUTÓNOMA][]	30
Writing of reports or projects [AUTÓNOMA][Self-study]	30
Other off-site activity [AUTÓNOMA][]	30
Final test [PRESENCIAL][Assessment tests]	2
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	2
Mid-term test [PRESENCIAL][Assessment tests]	1

Unit 1 (de 6): Fundamental concepts in coordination chemistry

Group 20:

Initial date: 12-09-2023 **End date:** 29-09-2023

Group 23:

Initial date: 12-09-2023 **End date:** 29-09-2023

Unit 2 (de 6): Thermodynamic and kinetic in coordination compounds

Group 20:

Initial date: 03-10-2023 **End date:** 20-10-2023

Group 23:

Initial date: 03-10-2023 **End date:** 20-10-2023

Unit 3 (de 6): Basics Organometallic Chemistry.

Group 20:

Initial date: 23-10-2023 **End date:** 03-11-2023

Group 23:

Initial date: 23-10-2023 **End date:** 03-11-2023

Unit 4 (de 6): Types of reactivity in organometallic compounds.

Group 20:

Initial date: 07-11-2023 **End date:** 27-11-2023

Group 23:

Initial date: 07-11-2023 **End date:** 27-11-2023

Unit 5 (de 6): Synthesis, structure and properties of organometallic compounds.

Group 20:

Initial date: 28-11-2023 **End date:** 20-12-2023

Group 23:

Initial date: 28-11-2023 End date: 20-12-2023

Unit 6 (de 6): Laboratory work.

Group 20:

Initial date: 06-11-2023 End date: 01-12-2023

Group 23:

Initial date: 06-11-2023 End date: 01-12-2023

Global activity

Activities	hours
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	2
Mid-term test [PRESENCIAL][Assessment tests]	1
Class Attendance (practical) [PRESENCIAL][Combination of methods]	20
Writing of reports or projects [AUTÓNOMA][Self-study]	30
Problem solving and/or case studies [PRESENCIAL][]	5
Other off-site activity [AUTÓNOMA][]	30
Class Attendance (theory) [PRESENCIAL][Combination of methods]	30
Study and Exam Preparation [AUTÓNOMA][]	30
Final test [PRESENCIAL][Assessment tests]	2
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	City	ISBN	Year	Description
Bochmann, Manfred	Organometallics 1 : complexes with transition metal-carbon	Oxford University Press		0-19-855750-7	2003	
Crabtree, Robert H.	The organometallic chemistry of the transition metals	John Wiley and Sons		0-471-66256-9	2005	
J. Ribas Gispert	Química de la Coordinación	Universidad de Barcelona			2000	
Purcell, Keith F.	Química inorgánica	Reverté		84-291-7478-8 (o.c.)	1979	
Alexander Von Zelewsky	Stereochemistry of Coordination Compounds	Wiley and Sons. Oxford			1996	
Bochmann, Manfred	Organometallics 2 : complexes with transition metal-carbon	Oxford University Press		0-19-855813-9	2004	