COURSE DATA

Data Subject	
Code	36467
Name	Química Organometálica
Cycle	Grade
ECTS Credits	4.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	4	Second term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	16 - Inorganic Chemistry Applied	Optional

Coordination

Name	Department
ROMERO MARTINEZ, FRANCISCO MANUEL	320 - Inorganic Chemistry

SUMMARY

The aim of this course is to complete the basic knowledge about organometallic compounds that the students had from the previous “Inorganic Chemistry III”. The students will know how to classify this compounds, based on the different type of ligands. They will also study their particular reactivity and their importance in the most important processes in Homogenous Catalysis.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is recommended to have taken and successfully passed all the subjects of Inorganic Chemistry I, II and III.

OUTCOMES

1110 - Degree in Chemistry

- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge of the characteristics and behaviour of the different states of matter and the theories used to describe them.
- Demonstrate knowledge of the principles of quantum mechanics and their application to the description of the structure and properties of atoms and molecules.
- Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
- Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
- Handle chemicals safely.
- Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems.
- Relate chemistry with other disciplines.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.

LEARNING OUTCOMES

Understanding of the new concepts related with the different type of organometallic compounds and their particular reactivity. Understanding and design of the most important homogeneous catalytic cycles in which these complexes are involved, both in industrial and organic synthesis processes.

SPECIFIC KNOWLEDGE OF CHEMISTRY	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the bachelor's degree that contemplate the LEARNING OUTCOMES EUROBACHELOR®
The principal techniques of structural investigations, including spectroscopy.	**CE7:** Ability to recognize chemical elements and their compounds: preparation, structure, reactivity, properties and applications. **CE12:** Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes.
The characteristics of the different states of matter and the theories used to describe them.	**CE3:** Demonstrate knowledge of the characteristics and behaviour of the different states of matter and the theories used to describe them.
The principles of quantum mechanics and their application to the description of the structure and properties of atoms and molecules.	**CE5:** Demonstrate knowledge of the principles of quantum mechanics and their application to the description of the structure and properties of atoms and molecules.
The characteristic properties of elements and their compounds, including group relationships and trends within the Periodic Table.	**CE2:** Interpret the variation of the characteristic properties of chemical elements according to the Periodic Table. **CE7:** Ability to recognize chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
The structural features of chemical elements and their compounds, including stereochemistry.	**CE7:** Ability to recognize chemical elements and their compounds: preparation, structure, reactivity, properties and applications. **CE11:** Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials. **CE12:** Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes.

The properties of aliphatic, aromatic, heterocyclic and organometallic compounds.	**CE7:** Ability to recognize chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
	CE12: Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes.
The relation between bulk properties and the properties of individual atoms and molecules, including macromolecules (both natural and man-made), polymers and other related materials.	**CE11:** Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
COMPETENCES AND COGNITIVE SKILLS	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the bachelor's degree that contemplate the LEARNING OUTCOMES EUROBACHELOR®
Competences to present and argue scientific issues orally and in writing to a specialized audience.	**CE26:** Relate Chemistry to other disciplines. **CB4:** Students must be able to communicate information, ideas, problems and solutions to both expert and lay audience.
COMPETENCES AND SKILLS RELATED TO THE PRACTICE OF CHEMISTRY	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the bachelor's degree that contemplate the LEARNING OUTCOMES EUROBACHELOR®
Capacities to handle chemical products safely, taking into account their physical and chemical properties, including any risk associated with their use.	**CE17:** Manipular con seguridad los productos químicos.

Capabilities necessary to perform standard laboratory procedures as well as to use instrumentation in synthetic and analytical works, in both cases in relation to both organic and inorganic systems.	**CE18:** Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems.
Ability to interpret data derived from observations and laboratory measurements in terms of their relevance, and relate them to the appropriate theory.	**CE26:** Relate Chemistry to other disciplines.
GENERAL COMPETENCES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the bachelor's degree that contemplate the LEARNING OUTCOMES EUROBACHELOR®
Study skills necessary for professional development. These will include the ability to work autonomously.	**CB5:** Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
Ethics	**CB3:** Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

In relation to the Sustainable Development Goals (SDG) in this subject, it is expected that students will be able to develop more efficient processes (SDG 8), with a better use of raw materials (SDG 1, 6 and 7) and a lower CO_2 emission (SDG 13). In addition, students will acquire knowledge about the new applications of organometallic compounds in areas such as health (SDG 3) and the use of CO_2 as a raw material (SDG13).

DESCRIPTION OF CONTENTS

1. 1. Classification of Organometallic Compounds based on the Ligands

1.1 Introduction. General properties of organometallic compounds. Synthesis, bonding and structure.
1.2 (sigma)-bonded Ligands. Metal carbonyls. Metal alkyls and aryls. Metal alkylidenes and alkylidynes.
1.3 (pi)-bonded Ligands. Alkenes, alkynes, allyl complexes. Cyclopentadienyl and Arene compounds.
1.4 Phosphines and related ligands

2. 2. Reactivity

2.1 Ligand substitution reactions.
2. 2 Oxidative addition reactions.
2. 3 Reductive elimination reactions.
2. 4 Insertion and elimination reactions.
2. 5 Nucleophilic and electrophilic addition and abstraction.

3. 3. Applications. Homogeneous catalysis.

3.1 Activation of small molecules.
3.2 Homogeneous catalysis.
3.3 Alkene Isomerization and metathesis. Alkene oligomerization and polymerization.
3.4 Applications in organic synthesis.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Study and independent work	47,00	0
Preparation of evaluation activities	20,00	0
TOTAL	**112,00**	

TEACHING METHODOLOGY

Lectures and group tutorials.- In these classes the teacher will give an overview of the topic object of study with special emphasis on the new aspects or particular complexity. It also will carry out the specific application of the knowledge that students have acquired via the resolution of issues and practical problems that students have previously worked. Logically, these classes will be complemented with the personal study time of student.

EVALUATION

Tests consisting of written, oral and/or practical exams (70%). The acquired knowledge can be evaluated throughout the course and/or at the end with one or several tests.

Evaluation of group tutoring sessions (20%).

Continuous assessment of each student based on classroom activities, participation and degree of involvement in the teaching-learning process (10%).

Alternatively, the student may choose to be evaluated only (100%) with a final exam on the date set by the Faculty, communicating this fact to the teacher during the first two weeks of the course.

To pass, a global grade of 5 (out of 10) will be required.

The assessment criteria for the second call will be the same.

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30), "*it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents*".

REFERENCES

Basic

- The Organometallic Chemistry of the Transition Metals. 5th Ed., R. H.Crabtree. Ed. Wiley Interscience John Wiley and Sons, 2009.
- Organometallics. 3rd. Ed., Ch. Elschenbroich. Ed. VCH. 2005.
- Química Organometálica. D. Astruc. Ed. Reverté, 2003.
- Química Organometálica de los Metales de Transición. R.H Crabtree, E. Peris. Biblioteca Univ. Jaume I, 1997.
- Organometallics . 1,2 . M. Bochmann. Oxford Science Publications, 1994.