

**COURSE DATA****Data Subject**

<b>Code</b>	36467
<b>Name</b>	Química Organometálica
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	4.5
<b>Academic year</b>	2020 - 2021

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1110 - Degree in Chemistry	Faculty of Chemistry	4	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1110 - Degree in Chemistry	16 - Inorganic Chemistry Applied	Optional

**Coordination**

<b>Name</b>	<b>Department</b>
ROS LIS, JOSE VICENTE	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 these 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**

The previous section includes the competences contained in the document VERIFICA. This subject addresses part of the learning results of the matter Applied Inorganic Chemistry that allow to acquire specific knowledge of chemistry, cognitive skills and general skills recommended by the EUROPEAN CHEMISTRY THEMATIC NETWORK (ECTN) for the Chemistry Eurobachelor® Label. The following table lists the learning outcomes acquired in the subject Organometallic Chemistry related to the competences of the degree in Chemistry.

<b>SPECIFIC KNOWLEDGE OF CHEMISTRY</b>	
<b>The learning process should allow the degree graduates to demonstrate:</b>	
	<b>Competences of the subject Organometallic Chemistry that contemplate the learning outcomes EUROBACHELOR®</b>
Major aspects of chemical terminology, nomenclature, conventions and units.	Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units..(CE1)
The major types of chemical reaction and the main characteristics associated with them.	Demonstrate knowledge of the main types of chemical reaction and their main characteristics.(CE4)
The principal techniques of structural investigations, including spectroscopy	Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7).  Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes..(CE12).  Handle the instrumentation used in the different areas of chemistry.(CE19).  Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.(CE8)
The principles of quantum mechanics and their application to the description of the structure and properties of atoms and	Demonstrate knowledge of the principles of quantum mechanics and their application to the description of the structure and properties of atoms and molecules..(CE5).



molecules	
The kinetics of chemical change, including catalysis; the mechanistic interpretation of chemical reactions	Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry..(CE6).
The characteristic properties of elements and their compounds, including group relationships and trends within the Periodic Table	<p>Interpret the variation of the characteristic properties of chemical elements according to the periodic table..(CE2).</p> <p>Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7).</p>
The structural features of chemical elements and their compounds, including stereochemistry.	<p>Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7).</p> <p>Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.CE11).</p> <p>Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes..(CE12).</p>
The properties of aliphatic, aromatic, heterocyclic and organometallic compounds.	<p>Demonstrate knowledge of the main types of chemical reaction and their main characteristics.(CE4)</p> <p>Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7).</p> <p>Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.(CE8).</p> <p>Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes..(CE12).</p>

**COMPETENCES AND COGNITIVE SKILLS**

The learning process should allow the degree graduates to demonstrate:

	<b>Competences of the subject Organometallic Chemistry that contemplate the learning outcomes EUROBACHELOR®</b>
Ability to demonstrate knowledge and understanding of the facts, concepts, principles and fundamental theories related to the topics mentioned above.	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry..(CE13).
Ability to apply this knowledge and understanding to the solution of common qualitative and quantitative problems.	Solve qualitative and quantitative problems following previously developed models..(CE14). Recognise and analyse new problems and plan strategies to solve them..(CE15). Understand the qualitative and quantitative aspects of chemical problems..(CE24).

On completing this course in Organometallic Chemistry, students will have acquired the following skills and abilities:

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.

**DESCRIPTION OF CONTENTS****1. Different type of Organometallic Compounds based on the Ligands**

1.1 Introduction. General properties of the organometallic compounds. Synthesis, Bonding and structure.

1.2 "sigma"-Bonded Ligands. Metal carbonyls. Metal alkyls and aryls. Metal alkylidenes and alkylidyne.

1.3 "pi"-Bonded Ligands. Alkenes, alkynes, allyl complexes. Cyclopentadienyl and Arene compounds  
Bonding of small molecules.

1.4 Phosphines and related ligands.





## 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. Applications

- 3.1 Catalysis
- 3.2 Other applications.

## WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Study and independent work	47,50	0
Preparation of evaluation activities	20,00	0
<b>TOTAL</b>	<b>112,50</b>	

## 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, seminars, tasks and/or oral expositions (10%).

Continuous assessment of each student based on classroom activities, participation and degree of involvement in the teaching-learning process (20%).



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

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

## REFERENCES

### Basic

- The Organometallic Chemistry of the Transition Metals. 6th Ed., R. H. Crabtree. Ed. Wiley Interscience John Wiley and Sons, 2014.
- Química Organometálica de los Metales de Transición. R.H Crabtree, E. Peris. Biblioteca Univ. Jaume I, 1997.
- Organometallics. 3rd. Ed., Ch. Elschenbroich. Ed. VCH. 2005.
- Química Organometálica. D. Astruc. Ed. Reverté, 2003.
- Organometallics . 1,2 . M. Bochmann. Oxford Science Publications, 1994.

## ADDENDUM COVID-19

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

**English version is not available**