COURSE DATA

DATA SUBJECT

Code: 36467
Name: Organometallic Chemistry
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Inorganic Chemistry Applied	ELECTIVES

COORDINATION

ROMERO MARTINEZ FRANCISCO MANUEL

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. 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).

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.

COMPETENCES / LEARNING OUTCOMES

1110 - Degree in Chemistry

At the end of the course, the student will be able to describe the characteristics and behaviour of the different states of matter and the theories used to explain them.

At the end of the course, the student will be able to identify chemical elements and compounds, including their production, structure, reactivity, properties and applications.

At the end of the course, the student will be able to identify the structure and reactivity of the main classes of biomolecules and the chemistry of key biological processes.

At the end of the course, the student will be able to state the principles of quantum mechanics and apply them to the description of the structure and properties of atoms and molecules.

At the end of the course, the student will interpret the relationship between the variation of the characteristic properties of chemical elements and the periodic table.

At the end of the course, the student will relate chemistry to other disciplines.

Capacidad de análisis, síntesis y razonamiento crítico en la aplicación del método científico.

Comprender las particularidades contables que presenta la regulación jurídico-mercantil de las empresas, relacionando la legislación mercantil aplicable a los distintos tipos operaciones societarias con la contabilidad de los hechos económicos que se regulan. Aprender a relacionar las leyes mercantiles que se ocupan de los concursos de acreedores con la contabilidad, adquiriendo práctica en el manejo de determinados textos legales vigentes.

Contribute to the design, development and implementation of solutions that address social needs, taking the Sustainable Development Goals as a reference.

Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Ser capaces de analizar la influencia que sobre el diseño del sistema de información de costes, ejercen, tanto la actividad concreta desarrollada por la entidad como la tecnología utilizada, la estructura organizativa y el estilo de dirección. Calcular costes preestablecidos y relacionarlos con la planificación y el control de la actividad interna. Seleccionar aquellos indicadores de gestión que faciliten el desempeño personal, estableciendo la frecuencia y el formato en función del usuario de destino.

DESCRIPTION OF CONTENTS

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. 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. 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.

4. Laboratory sessions

Introduction to the synthesis and handling of chemical compounds under inert atmosphere. Setup of a vacuum line. Synthesis of cis-$[Mo(CO)_4L_2]$ compounds by substitution reactions starting from $Mo(CO)_6$. Study of thermal isomerization reaction of cis-$[Mo(CO)_4(PPh_3)_2]$ to afford the trans-$[Mo(CO)_4(PPh_3)_2]$ isomer. Characterization of the different products by IR spectrometry and determination of the isomeric form obtained in each experiment via analysis of carbonyl stretching vibration bands.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	4,00
Theory	25,00
Laboratory	16,00
Total hours	**45,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	47,00
Preparation of lessons	0,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**67,00**

TEACHING METHODOLOGY

Lectures and group tutorials.- In these lectures the teacher will give an overview of the topic object of study with special emphasis on the new aspects of particular complexity. The specific application of the knowledge that students have acquired via the resolution of issues and practical problems will also be undertaken. The lectures will be complemented with personal study time of the students.
Laboratory sessions. Students will be initiated across four lab sessions in the techniques of synthesis and handling of chemical compounds under inert atmosphere.

EVALUATION

EVAL1: Assessment of lab sessions: attitude, skills, lab notebook, results of experiments, reports and oral communication (25 %).
EVAL2: Laboratory part: Written, oral and practical exams (25 %).
EVAL3: Theory part: Written, oral and practical exams (40 %).
EVAL4: Continuous assessment of each student based on in person activities (sessions of teamwork, seminars¿): participation, elaboration of works and/or oral communications and extent of implication in the teaching-learning process (10 %).

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

- 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.