Universidad Zaragoza

Year : 2019/20

27234 - Organometallic Chemistry

Syllabus Information

Academic Year: 2019/20
Subject: 27234 - Organometallic Chemistry
Faculty / School: 100 -

Degree: 452 - Degree in Chemistry

ECTS: 5.0
Year: 4
Semester: Second semester
Subject Type: Optional
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, laboratory sessions, autonomous work, study and assessment tasks.

Students are expected to participate actively in class throughout the semester.

Further information regarding the course will be provided on the first day of class.

4.2.Learning tasks

The course includes the following learning tasks:

1. Learning activity to acquire basic knowledge of Organometallic Chemistry. (4 ECTS). This activity comprises 40 sessions (50 min/session) of lecture-interactive classes in a large group, part of the lecture will be dedicated to solving problems associated with the corresponding topics.
2. Formative laboratory activity. (1 ECTS). It will be held in the laboratory Nº 1 on the basement of building D, in three sessions of 3.3 hours. This activity is an obligatory attendance in which the students, individually, will carry out the synthesis of a series of ligands and complexes that must characterize from the spectroscopic data that the teachers

will provided.

3. Tutorials. Teachers will reserve 6 hours a week for individual tutorials with the students.

4.3.Syllabus

The course will address the following topics:

- **Topic 1**.- Milestones in Organometallic Chemistry. Ligands: types and geometry. Organometallic compounds: types. Energy, Polarity and reactivity of the M-C bond.
- **Topic 2**.- Main group Organometallics. Syntheses. Experimental techniques. Purification. Structural characterization.
- **Topic 3**.- Structure and bonding of the main group organometallic complexes. Properties.
- **Topic 4**.- Transition metal organometallic complexes. The 18 valence e rule (18VE).
- **Topic 5**.- Transition metal organometallic complexes: ??donor ligands. Preparation of transition-metal-alkyl and -aryl compounds. Thermodinamic versus Kinetic Lability. Reactivity: Insertion reactions. Alkenyl and alkynyl complexes. Complexes containing metal-hydride bonds.
- **Topic 6**.-. Organometallic complexes with sigma interactions. Metal-dihydrogen complexes. Complexes containing M-sigma (H-C) interactions (agostic). Complexes with M-sigma interactions (H-X) (X = B, Si ...) and some different cases. Oxidant addition processes of H-H, H-C, H-X bonds and some different examples.
- **Topic 7**.- Metal carbonyls. Bonding modes. Synthesis, structure and reactivity. Carbonyl metallates and carbonyl metal hydrides. Isocyanide complexes.
- **Topic 8**.- Transition metal carbene complexes. Transition metal carbyne complexes. Synthesis, structure and reactivity.
- **Topic 9**.- Transition metal complexes with olefins. Preparation, structure and bonding. Alkyne complexes. Bridging or terminal alkynes. Transition metal allyl and enyl derivatives. Preparation, structure, bonding and reactivity.
- **Topic 10**.- Transition metal complexes with aromatic rings. Complexes sandwich and semi-sandwich. Complexes with three or four members aromatic rings. Cyclopentadienyl derivatives. Binary cyclopentadienyl complexes. Metal complexes with benzene or its derivatives as ligands. Bis(arene) metal complexes. Semi-sandwich arene metal carbonyls. Complexes with seven or eight members aromatic rings.
- **Questions:** The 18 valence e rule (18VE). Insertion reactions. Oxidative addition reactions. Nucleophilic attack reactions: Davies, Green and Mingos rules. Questions on complexes with type ? ligands.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Facultad de Ciencias web (https://ciencias.unizar.es/grado-en-quimica-0).

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=27234&year=2019