Universidad Zaragoza

Academic Year/course: 2023/24

27214 - Inorganic Chemistry II

Syllabus Information

Academic year: 2023/24
Subject: 27214 - Inorganic Chemistry II
Faculty / School: 100 - Facultad de Ciencias
Degree: 452 - Degree in Chemistry
ECTS: 12.0
Year: 3
Semester: Annual
Subject type: Compulsory
Module:

1. General information

In this subject the student deepens their knowledge of Inorganic Chemistry, so that they can relate bonding, structure and properties of coordination compounds, inorganic solids and transition elements and their compounds, both from a theoretical and experimental point of view.

Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda https://www.un.org/sustainabledevelopment/es/): 4: Quality education; 7: Affordable and non-polluting energy; 8: Decent work and economic growth; 9; Industry, innovation and infrastructure; 12: Responsible Production and Consumption

To enrol in this subject, it is necessary to have taken Inorganic Chemistry I.

2. Learning results

- Understand and use sources of information on Inorganic Chemistry.
- Know the structure of coordination compounds and relate their stereochemistry and bonding to their spectroscopic and magnetic properties.
- Relate the structural and electronic characteristics of inorganic solids to their properties.
- Know the synthesis methodologies and characterization techniques of inorganic solids.
- Use bonding models and theories to predict and explain the chemical properties of inorganic compounds
- Know the chemistry of the transition elements and their compounds.
- Identify the most current research topics within Inorganic Chemistry
- Analyse and solve problems and questions on structure and reactivity of inorganic compounds.
- Know and perform the different experimental procedures to carry out the synthesis and characterization of inorganic products.
- Write reports in order to describe, organize and validate the experimental work carried out by applying the scientific method.

3. Syllabus

Theoretical classes

- Introduction to transition metal chemistry.
- Structure of coordination compounds. Types and characteristics of ligands.
- Stereochemistry in coordination compounds. Stereoisomerism. Chirality.
- Electronic structure in coordination compounds. Ligand field theory. Theory of molecular orbitals.
- Stability of coordination compounds. HSAB theory. Steric effects. Chelate and macrocyclic effects.
- Synthesis and reactivity of coordination compounds. Substitution reactions in octahedral compounds and plan square. Electron transfer reactions. Isomerization reactions.
- Electronic structure in solids. Band theory. One-dimensional solids: Peierls distortion. Ionic solids, covalent and metals.
- Electrical properties of solids. Electronic conductivity. Semiconductors. Oxides and sulphides of transition metals . Low dimensional solids.
- Defects, non-stoichiometry and solid solutions. Punctual and widespread defects. Ionic conductivity. Solid electrolytes.
- Preparation of solid materials. Solid state reactions. Synthesis methods. Vapor phase transport. Preparation of thin films.
- Transition metal compounds: halides. Binary halides. Halide clusters. Multiple bonding metal-to-metal. Synthesis and reactivity of halides.
- Transition metal compounds: oxides and oxohalides. Binary oxides. Synthesis and reactivity of oxides. Mixed oxides: spinels, perovskites and ilmenite. Superconductivity.
- The lanthanide and actinide elements.

Seminars

Symmetry, stereochemistry, 18-electron rule, electronic spectra, magnetism.

Laboratory practices

Practices related to the following aspects will be carried out: synthesis and characterization of coordination and organometallic, isomerism, solvatochromic properties, preparation and study of ionic conductors.

4. Academic activities

1.- Theoretical classes of Inorganic Chemistry (7 ECTS).

2.- Seminars: resolution of problems and questions, presentation of advanced topics (2 ECTS)

3.- Laboratory practices (3 ECTS, in sessions of 3-4 hours)

4.- Tutoring. Students will have 6 hours per week for individualized tutoring

5. Assessment system

1.- **Seminars and problems**. Problem solving tests, theoretical and practical questions and related activities.

2.- **Laboratory practices**. The laboratory will be graded on the quality of the work developed, the notebook and/or laboratory scripts and a written test. If this part is passed (minimum grade of 5) the grade will be saved for the two calls of the academic year. If this part is not passed, the student will take a written test in the global evaluation period.

3.- **Theoretical part.** There will be a midterm exam at the end of the first semester and a final exam in the global evaluation period The exams will consist of the resolution of problems and theoretical-practical questions. The first midterm will be a topic “elimination” exam in the first call, so that students who pass it (minimum grade of 5) may only take the part corresponding to the second midterm of the final exam, in which they must obtain a minimum grade of 5. The grade for the theoretical part will be the average of the two midterm exams. Students taking the full final test must obtain a grade equal to or higher than 5.

In the first call, the final grade will be the best of the two following options:

Final grade 1 = Seminars (15 %) + Practrices (15 %) + Theoretical part (70 %)

Final grade 2 = Practices (15 %) + Theoretical part (85 %)

In the second call all students must take the complete final test of the theoretical part and the final grade will be as follows:

Final grade = Practices (15 %) + Theoretical part (85 %)