

27214 - Inorganic Chemistry II

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	452 - Degree in Chemistry
ECTS	12.0
Course	3
Period	Annual
Subject Type	Compulsory
Module	---

1. Basic info

1.1. Recommendations to take this course

1.2. Activities and key dates for the course

2. Initiation

2.1. Learning outcomes that define the subject

2.2. Introduction

3. Context and competences

3.1. Goals

3.2. Context and meaning of the subject in the degree

3.3. Competences

3.4. Importance of learning outcomes

4. Evaluation

5. Activities and resources

5.1. General methodological presentation

5.2. Learning activities

5.3. Program

1.- Introduction to transition metal chemistry.

The *d*-block transition metals: general aspects. Occurrence, abundance, extraction and applications. Physical properties.

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Electronic configurations. Periodic trends in the chemical properties. Relativistic effects. Lanthanide contraction. Transition metal compounds: representative examples.

2.- Structure of coordination compounds.

Basic concepts. Polydentate ligands and design of complexes. Electronic characteristics of ligands. Ligands and electrons.

3.- Stereochemistry of coordination compounds.

Stereoisomerism. Describing configuration in coordination compounds. Chirality in coordination compounds. Optical activity. Resolution of enantiomers.

4.- Electronic structure of coordination compounds.

Ligand field theory. Molecular orbital theory. Molecular orbitals for octahedral complexes with s bonding, octahedral complexes with s and p bonding. Molecular orbitals for tetrahedral and square-planar complexes. Ligand field stabilization energy: structural and thermodynamic effects. The 18-electron rule. Electronic spectra and magnetism in coordination compounds.

5- Stability of coordination compounds.

Thermodynamic stability of coordination compounds. Factors influencing the stability of coordination compounds. The Irving-Williams series. Hard and soft (Lewis) acids and bases. Steric effects. Chelate and macrocyclic effects. Stabilization of unusual oxidation states.

6- Synthesis and reactivity of coordination compounds.

Classification of the reactions. Kinetic stability of the coordination compounds. Substitution reactions on octahedral complexes. Stereochemistry in substitution reactions. Substitution reactions on square planar complexes. Trans influence and trans effect. Electron transfer reactions. Isomerization reactions. Reactions on coordinated ligands.

7.- Electronic structure of solids.

Electrons in solids. Band theory: crystal orbitals, bands of energy, density of states and Fermi level. Electronic structure of one-dimensional solids: Peierls distortion. Electronic structure of ionic and covalent solids, and metals.

8.- Electrical properties of solids.

Electronic conductivity. Semiconductors. Photoconductivity. p-n junctions: applications. Semiconductor compounds isoelectronic with silicon. Electronic structure and properties of inorganic solids: transition metal oxides and sulphides. Low-dimensionality solids: polyacetylene, KCP, graphite. Superconductivity.

9.- Crystal defects, non-stoichiometric solids and solid solutions.

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Imperfections in solids. Defects classification. Point defects. Solid solutions. Ionic conductivity. Solid electrolytes. Non-stoichiometric solids. Extended defects.

10.- Preparation of solid materials.

Solid state reactions. Thermodynamic control: phase diagrams. Kinetic control. Synthetic methods. Intercalation reactions. Vapour-phase transport deposition. Thin film preparation techniques.

11.- Transition metal compounds: halides.

Transition metal halides: binary halides, hydrated halides and halide clusters. The multiple metal-metal bond. Synthesis of transition metal halide compounds. Reactivity of transition metal halide compounds.

12.- Transition metal compounds: oxides and molecular oxohalides.

Structure and properties of binary oxides. Synthesis and reactivity of transition metal oxides. Mixed oxides: spinels, perovskites and ilmenite. Properties.

13.- Lanthanides and actinides elements.

The *f*-block elements. General aspects and chemical behaviour. Oxidation numbers. Lanthanide and actinide chemistry. Applications.

5.4.Planning and scheduling

(<http://ciencias.unizar.es/web/horarios.do>)

5.5.Bibliography and recommended resources

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- Shriver & Atkins Química inorgánica / Peter Atkins ... [et al.] ; traducción técnica, Emilio Sorde Zabay ; revisión técnica, Rodolfo Álvarez Manzo, Oralia Orduño Fragoza. - 4ª ed., 1ª ed. en español México D. F. : McGraw-Hill/Interamericana, cop. 2008
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- Greenwood, Norman Neill. Chemistry of the elements / N.N. Greenwood and A. Earnshaw . - 2nd ed. Oxford : Butterworth-Heinemann, 1997
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- Rodgers, Glen E.. Química inorgánica : Introducción a la química de coordinación, del estado sólido y descriptiva / Glen E. Rodgers ; traducción M. Victoria Cabañas... [et al.], revisión técnica María Vallet Regi . - [1a. ed. en español] Madrid [etc] : McGraw-Hill, D.L. 1995
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- Gerloch, Malcolm. Transition metal chemistry : the valence shell in d-block chemistry / Malcolm Gerloch, Edwin C. Constable Weinheim [etc.] : VCH, cop. 1994
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 - Carriedo, Gabino A.. La química inorgánica en reacciones / Gabino A. Carriedo . Madrid : Síntesis, D.L. 2010
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