# UE Coordination and supramolecular chemistry

Level
Baccalaureate +4

ECTS
6 credits

Component
UFR PhITEM (physique, ingénierie, terre, environnement, mécanique)

Semester
Automne

- **Teaching language(s):** English
- **Open to exchange students:** Yes
- **Code d'export Apogée:** PAX7NAAB

# Presentation

## Description

*Goal:* These lectures will introduce you into the world of coodination chemistry both on a synthetic and a physico-chemical points of view.

*Content:*

**I. General concepts in coordination chemistry**

- Metal ions and ligands
- Nomenclature of complexes
- Geometry of complexes with different coordinence
- Isomerism in coordination compounds

**II. Thermodynamic and kinetic approaches of complexes in solution**

- Formation constants: definition and experimental determination
- Chelate effect, a central concept in coordination and supramolecular chemistry
- Applications to supramolecular recognition of cations
- Inertia and lability, essential kinetic notions for understanding complexes reactivity
- Synthesis of complex dedicated ligands: crown-ethers, Schiff bases, polypyridine, ...

**III. Electronic structure of metal complexes**

- Counting electrons in complexes: the Green's method
- 16/18 electrons rule
- Reactions implying metal complexes
- Application to homogeneous catalysis
- From crystal field to ligand field
- Construction of Molecular Orbitals diagrams of octahedral metal complexes
- Insight into spectroscopic series

**IV. Optical properties of metal complexes**

- Spectroscopic terms of metal complexes including lanthanide complexes
- Electronic spectroscopy of metal complexes
- Emission of light by metal complexes

**V. Magnetic properties of monometallic complexes**

- Origins of the magnetic properties of metal complexes
- Magnetic susceptibility
- From Van Vleck equation to Curie law
- Departures from Curie law
- Spin Cross-Over phenomenon: from definition to applications

**Article Analysis**

Every student will study and present an article dealing with an application strongly related to the contents of the lecture.

**Practical teachings:**

Four topics of the lectures will be illustrated during four hours experimental work sessions:

- Synthesis and study of the luminescent properties of lanthanide complexes
- Biomimetic model of molybdic oxo-tranferase enzyme
- Synthesis and properties of a iron(II) spin Cross-Over compound [1]
- Syntheis and study of a mixed-valence compound

To anticipate the Lab work, the practical work is written by each student in a dedicated Labwork notebook [2].

[1] A. Vallée *et al., J. Chem. Educ.* **2013**, *90*, doi: 10.1021/ed4000487

[2] A. Eisenberg *J. Chem. Educ.* **1982**, *59*, 1045.

## Course parts

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|---|---|---|
| UE Coordination and supramolecular chemistry - CMTD | Lectures (CM) & Teaching Unit (UE) | 36h |
| UE Coordination and supramolecular chemistry - TP | Practical work (TP) | 16h |

## Recommended prerequisites

Prerequisites: Basics knowledge of general chemistry (electronic structure of the elements, thermochemistry...), in group theory and in coordination chemistry (general definitions, crystal field theory)

**Period :** Semester 7

## Bibliography


- Inorganic Chemistry by J. E. Huheey
- Inorganic Chemistry by D. Shriver and P. Atkins
- Supramolecular Chemistry by J. M. Lehn
- Molecular Magnetism by O. Kahn
- Electrons in Molecules by J. P. Launay and M. Verdaguer


# Useful info

## Place

Grenoble

## Campus

Grenoble - University campus