

## IDENTIFICATION

Course code : E1CP1PC1  
ECTS : 1

## DURATION

Lectures : 10  
Tutorial classes : 12  
Labs : 0  
Total : 22

Project :  
Personnal work :

## ASSESSMENT

Written exam : 2.0h - Coefficient : 1.0  
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## TEACHING MATERIALS

Materials available on the Moodle platform.

## LANGUAGE

English

## CONTACT

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## UE : PHYSIQUE-CHIMIE

## COURSE : Matter Architecture

## SCOPE OF THE COURSE

### OBJECTIVES

Understanding the structure of a chemical building and its interaction with other molecules in a phase.

### COMPETENCE AND SKILLS

- Know how to define the terms : element, nuclide, and isotope.
- Know how to define isotopic abundance and use it to calculate an average molar mass.
- Know how to define covalent and ionic radii.
- Know how to define first ionization energy, electron affinity, and electronegativity (know the usual scales).
- Know how to describe the construction of the periodic table and the evolution of periodic properties.
- Know how to identify the families : alkali metals, alkaline earth metals, halogens, noble gases.
- Know how to place the metal/non-metal boundary.
- Know how to locate an element given its atomic number.
- Know how to predict possible oxidation states and count valence electrons.
- Know how to give the Lewis structure of an atom (2nd period) and define valence.
- Know how to define the chemical bond according to Lewis and apply the octet rule.
- Know how to recognize an electron deficiency and place formal charges.
- Know how to construct a Lewis structure and understand hypervalence.
- Know how to write limiting mesomeric forms and the resonance hybrid, relate mesomerism to stability.
- Know how to state and use the VSEPR model; know the coordination polyhedra.
- Know how to determine the VSEPR type and the geometry around a central atom, justify deviations from ideal geometry.
- Know how to define the dipole moment (and its units) and calculate an ionicity percentage.
- Know how to calculate the dipole moment of a molecule from those of the bonds and the geometry.
- Know how to describe intermolecular interactions : charge/charge, charge/dipole, dipole/dipole, Keesom, Debye, London.
- Know how to define the polarizability of a bond and assess the effect of interactions on state changes.
- Know how to define the hydrogen bond and give orders of magnitude of interaction energies.
- Know how to describe the dissolution of a solute in a solvent.
- Know how to characterize a solvent (polar/apolar, protic/aprotic).
- Know how to choose a solvent adapted to the polarity of a solute.

## PROGRAM

**1. Periodic Classification**

— Organization of the periodic table and periodic properties.

**2. Covalent Bonding and Molecular Geometry**

— Lewis structures, VSEPR model, polarity of bonds and molecules.

**3. Intermolecular Interactions**

— van der Waals forces, hydrogen bonds, relation to macroscopic properties.

**4. Crystal Structure**

— Types of crystals, main geometries and coordinations.

**5. Practical Work** : dissolution, dilution, titration (methodology).

## **BIBLIOGRAPHY**

## **REQUIREMENTS**