BASICS OF CHEMICAL, PHYSICOCHEMICAL AND BIOCHEMICAL SYSTEMS FIELD_13 ECTS

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Organic chemistry

Introducing

Description

Part I: Spatial and electronic structures.
- Hybridization of atomic orbitals and geometry of organic molecules.
- Nomenclature.
- Constitutional and conformational isomerism.
- Stereochemistry (enantiomerism, diastereosisomerism).
- Electronic effects: polarity, polarizability, inductive and mesomeric effects.
- Structure-reactivity relationship: the main classes of reagents: acids, bases, nucleophiles, electrophiles, reaction intermediates: carbocations, carbanions, free radicals.

Part Two: Reactivity of compounds. The main reaction mechanisms.

- Radical substitutions on alkanes (SR).
- Electrophilic additions to alkenes (AE).
- Electrophilic substitutions on arenes (SE).
- Nucleophilic substitutions in aliphatic series (SN1 and SN2).
- Elimination reactions (E1 and E2).

Basic practical work:
- Doubling of a racemic mixture.
- Chemical synthesis.
Acquire and implement the main experimental techniques (distillation, extraction, reflux set-up, recrystallisation, TLC and silica gel column chromatography).
- Raise students' awareness of safety during chemical manipulations.

UV visible spectrophotometry: principles, theory, Beer Lambert's Law.
IR and NMR spectroscopy: principles, equipment, interpretation of spectra.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):

- the spatial and electronic structures of molecules in order to understand the main reaction mechanisms and their stereochemical consequences.

- the basic reaction mechanisms of chemical reactions in the living world and industrial organic chemistry.

The student should be able to:

- Identify the main chemical functions and name chemical compounds.
- Represent chemical compounds (Newman, Fischer, Cram).
- Distinguish between the different types of isomerism: conformational and configurational isomerism (enantiomerism, diastereoisomerism).
- Analyse electronic effects (inductive effects and mesomeric effects) in a molecule.
- Describe the different classes of reagents and reaction intermediates.
- Describe the main reaction mechanisms encountered in chemistry: Radical substitutions on alkanes (SR), Electrophilic additions on alkenes (AE), Electrophilic substitutions on arenes (SE), Nucleophilic substitutions in aliphatic series (SN1 and SN2), Elimination reactions (E1 and E2).
- Carry out organic syntheses using the basic experimental techniques of organic chemistry.
- Use the various techniques for characterising organic compounds (UV, IR, NMR)

- Interpret UV, IR and NMR spectra

Necessary prerequisites

I1ANETCH Atomistic
I1ANETCH Solution chemistry

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Practical info

Location(s)

Toulouse

Thermodynamics of physical-chemical systems

Introducing

Description

Systems, quantities and properties of states
Energy description of systems
Macroscopic properties of pure components
Description of physicochemical systems
Reaction quantities
Chemical potential and fugacity
Real solutions
Characterization of phase equilibria
Chemical equilibrium

Objectives

At the end of this module, the student will have acquired systematic practice in the implementation of material and energy balances with chemical reactions, and analyzes in closed and open energy systems. He will understand the behavior of real fluids, the generalized formulation of these behaviors using equations of state, their behavior in saturation zones, the main associated thermodynamic diagrams and their application to various systems.

He will have acquired the basics of thermochemistry including reaction quantities as well as the influence of temperature on these quantities (Kirschhoff), the heat of reaction, and will apply this knowledge to reactive systems under various conditions both theoretically through supervised work and practically in TP.

He will also have acquired the bases for the description of physicochemical systems and solutions (ideal/non-ideal) allowing the characterization and calculations of equilibrium between phases in the solutions. These bases are necessary for understanding and sizing unit operations in chemical and biochemical systems.

He will understand and apply the concepts associated with chemical equilibria: limitation of reaction progress, stability, instability and spontaneity of chemical reactions, chemical equilibrium constant, displacement of the equilibrium (Lechatelier's law).

He will apply this knowledge to homogeneous equilibria in the gas phase and in the condensed phase as well as to heterogeneous chemical equilibria.

Necessary prerequisites

UF « Thermodynamique Bases et applications » (code I1ANTH11) de la première année de l'INSA ou équivalent.

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Practical info

Location(s)

Toulouse

Structural Biochemistry

Introducing

Description

Detailed description of the structure of the molecules listed below and their major role in the cellular functioning of living beings:
- Monosaccharides, oligosaccharides, and polysaccharides
- Fatty acids and lipids
- Nucleotides and nucleic acids (DNA and RNA)
- Amino acids and proteins

Description and implementation of several analytical methods to elucidate the structure of certain compounds.
Introduction to the study and use of these biomolecules for biotechnologies in the context of ecological transition, sustainable development, and the bioeconomy.

Objectives

By the end of this module, students should have understood and been able to describe the overall structure of the four major classes of biomolecules that make up living systems (carbohydrates, lipids, nucleic acids, and proteins), as well as their function in cells. Students will also be aware of the great diversity that exists in the living world and its importance. They will also be able to cite certain techniques for analyzing these molecules and should be familiar with some simple examples of their relevance to biotechnology.

Necessary prerequisites

I1ANBC11 Chemistry
I2BECH11 Organic chemistry

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