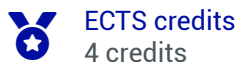


Chemistry - Process Engineering



ECTS credits
4 credits

In brief

> **Course language:** French, English

Presentation

Prerequisites

Basic knowledge of chemistry, process engineering and fluid mechanics.

Learning objectives

Chemistry :

- Know the principles of kinetic or thermodynamic control, charge control, orbital or steric control underlying chemical reactions.
- Know the properties and reactivity of benzene and its derivatives. Know the properties and reactivity of the carbonyl function, a very versatile chemical function in organic chemistry.
- Know the electronic structure of organometallic complexes, the nature of the metal ligand bond and the mechanisms of ligand substitution - Oxidative addition - Reductive elimination - Insertions and eliminations.

Process engineering :

- Acquire knowledge of material transfer for a continuous medium and in the vicinity of an interface
 - Apply this knowledge to liquid-liquid extraction without partial miscibility up to the dimensioning of a mixer-settler battery, a tray column and a packed column
-

Description of the programme

Chemistry - Organic and organometallic reactivity:

- Part 1: Electrophilic addition on alkene - benzene and its derivatives: aromaticity, resonance - reactivity of benzene and its derivatives: aromatic electrophilic addition (halogenation, nitration, sulfonation - Friedel and Crafts alkylation) - poly substitution: regioselectivity.

- Part 2: structure and properties of the carbonyl function - preparation of carbonyl derivatives: oxidation of alcohols, transposition - reactivity of carbonyl derivatives: nucleophilic attack by water, alcohols, amines, reduction by hydrides and organomagnesiums and organolithiums, ylides (Wittig reaction) - oxidation of ketones - enols and enolates: C-alkylation and O-alkylation, aldolization.
- Part 3: organometallic chemistry and catalysis, organometallic complexes: electronic structure of complexes - metal-ligand bonding - reaction mechanisms - ligand substitution - oxidative addition - reductive elimination - insertions and eliminations - reactions on coordinated ligands - general principles of catalysis: hydrogenation - hydroformylation.

Process Engineering:

- Matter transfer: Matter transfer in continuous medium, mechanisms: diffusion and convection. Local balance: continuity equation
- Matter transfer at an interface: film model, transfer coefficients, dimensional analysis and main adimensional numbers, analogy
- Liquid-liquid extraction: Introduction to separative methods, theoretical stage, cross-flow mixer-settler battery, tray column, packed column

Generic central skills and knowledge targeted in the discipline

Chemistry:

- Know how to approach the chemical reaction in terms of controls (kinetic or thermodynamic, charge control, orbital or steric).
- Predict the selectivity and stereochemistry of the products formed.
- Control the selectivity and stereochemistry of the products formed.
- Predict the reactivity of an organometallic complex.
- Predict its structural and electronic modifications throughout a catalytic cycle in contact with the reaction medium.

Process Engineering:

- Know how to approach a problem related to material transfer.
- Distinguish the different mechanisms of matter transfer and formulate their associated equations.
- Predict the performance of a liquid-liquid extraction operation.
- Predict the dimensions and operating conditions of a liquid-liquid extraction unit.

How knowledge is tested

DS chimie (2/3) - GP (1/3) : 50 %

CC (TD + TP + TA) chimie (2/3) - (TD + TA) GP (1/3) : 50 %

Bibliography

Online resources on the Ecole Centrale educational portal.

Books (documentation centre).

Teaching team

Chimie :

- Bastien Chatelet
- Didier Nuel
- Laurent Giordano
- Alexandre Martinez
- Innocenzo De Riggi
- Cédric Colombar

Génie des procédés :

- Pierrette Guichardon
- Pascal Denis
- Nelson Ibaseta
- Audrey Soric

- Jiupeng Du

Sustainable Development Goal



Responsible consumption and production

Total des heures

| | | |
|----|----------------|------------|
| CM | Master class | 24h |
| TD | Directed work | 22h |
| TP | Practical work | 8h |
| AA | | 18h |
| | | 72h |

Useful info

Name responsible for EU

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