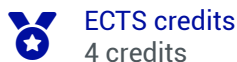


Chemistry - Process Engineering



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
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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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