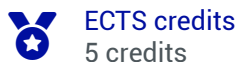


Chemistry - Process Engineering



ECTS credits
5 credits

In brief

> **Course language:** French

Presentation

Learning objectives

In chemistry:

- know the general principles of chemical kinetics and thermodynamics as well as structure-property relationships of molecules
- Know the reactive molecular entities
- Know the general concepts of organic reactivity

In process engineering:

- Know how to apply material and energy balances, with and without chemical reaction, in steady state on a system
- Know and know how to calculate the volume of ideal reactors (closed reactor, perfectly agitated, piston) in simple cases.
- In the case of perfectly stirred reactors, know how to calculate the adiabatic temperature
- To approach the transient regime
- Apply this knowledge to the distillation of a binary mixture
- Know the thermodynamics of liquid/vapor equilibrium
- Know how to dimension a tray rectification column in continuous and batch modes.

Description of the programme

In Chemistry:

Molecular Structure:

1. Chemical element and atom - Electronic configurations - Lewis theory - Geometry of molecules
- Molecules - Quantum model of the atom - Molecular orbitals - Hückel's method

- 2. Formal chemical kinetics - Speed and order of reaction and rate constant - Kinetics of complex reactions (parallel, consecutive reactions) - Mechanisms - Activation thermodynamics Thermodynamics of activation - Kinetic/thermodynamic control
- 3. Chemical thermodynamics - Standard state - State functions
First principle and applications - The chemical potential - Second principle and evolution of chemical systems
Second principle and evolution of chemical systems

Organic reactivity :

- 1. Static stereochemistry (central and axial chirality) - Dynamic stereochemistry (conformational analysis)
- 2. Reactivity of alkanes and halogeno-alkanes, reactive species - Nucleophilic substitution - Elimination
- 3. Kinetic control, thermodynamic control - orbital control, charge control, steric control

In Process Engineering:

- 1. Balances and reactor:
 - Introduction to process engineering and unit operations
 - Global analysis of a manufacturing process
 - Application of global and partial balances without chemical reaction
 - Application of global and partial balances with chemical reaction
 - Energy balance, with and without chemical reaction
 - Introduction to reactors (process & technology aspects)
 - Particular case of ideal reactors
- 2. Distillation of a binary mixture :
 - Introduction to separative methods
 - Thermodynamics of liquid/vapour equilibrium
 - Flash distillation
 - Rectification in continuous mode: sizing by the Mac Cabe and Thiele method
 - Rectification in batch mode : Rayleigh equation and sizing.

Generic central skills and knowledge targeted in the discipline

In Chemistry:

- Be able to understand the kinetics and thermodynamics of molecular transformations
- Know how to identify the reactive species of a chemical system, know how to formulate hypotheses for a reaction mechanism
- Predict the selectivity and stereochemistry of a molecular transformation.

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 pedagogical portal
Books (documentation center)

Teaching team

Chimie :

- Bastien Chatelet
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- Alexandre Martinez
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Génie des procédés :

- Pierrette Guichardon
- Pascal Denis
- Nelson Ibaseta
- René Arnaud

Sustainable Development Goal



Responsible consumption and production

Total des heures		96h
CM	Master class	36h
TD	Directed work	32h
TP	Practical work	4h
AA		24h

Useful info

Name responsible for EU

Lead Instructor

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