BIRC2105 Chimie physique II

[52.5h+22.5h exercises] 6 credits

This course is taught in the 1st semester

Teacher(s): Patricio Ruiz Barrientos
Language: French
Level: Second cycle

Aims

Knowledge concerning the properties of matter and their understanding from the corpuscular/molecular scale.
Know-how in physical chemistry: quantification, conceptualisation, modelling.
Development of an adequate attitude towards the understanding of the properties of matter and their command.

Main themes

Implementation of two complementary physico-chemical approaches for the forecast and the command of properties of matter
Macroscopic properties and molecular interpretation
- Kinetics: Knowledge of fundamental laws regulating the progress of chemical reactions// Interpretation of kinetics experimental data to deduce reaction mechanisms.
- Phase equilibria: Study of phase equilibria of condensed systems (liquid/liquid; liquid/solid) and of liquid/vapor systems with several constituents: interpretation and use of phase equilibrium diagrams // Thermodynamic study of nonideal systems with several constituents (solutions): use of thermodynamic tools for solving phase equilibrium problems.
Properties of particles and forecast of macroscopic properties - Statistical mechanics.
Basic concepts // Application to gaseous systems // a priori calculations of thermodynamic quantities // Application to chemical free energy // Notions of non-equilibrium thermodynamics.

Content and teaching methods

Contents:
- KINETICS: Rate of chemical reaction. Relationship with chemical thermodynamics. Rate equations of chemical processes. Activation energy. Reaction orders. Influence of temperature. Absolute reaction rates theory. Collision and transition state theory. Irreversible and reversible reactions. Parallel and consecutive reactions. Degeneration of orders. Catalytic reactions kinetics. Kinetics of polymer formation reactions. Chain reactions.
- PHASE EQUILIBRIUM: Binary liquid-liquid, liquid-solid and liquid-vapor phase diagrams, ternary diagrams. Thermodynamics of nonideal and ideal solutions. Use of thermodynamic tools for the study of colligative properties of the diluted solutions (vapor pressure, boiling point, freezing point and osmotic pressure).
STATISTICAL MECHANICS: Introduction and fundamental concepts. Kinetic theory and the equation of state of a gas. A priori calculation of thermodynamic quantities. Application to chemical equilibrium. Introduction to non-equilibrium thermodynamics.
Methods
Courses and exercises concentrating on concrete use of the concepts.

Programmes in which this activity is taught

BIR2 Bio-ingénieur