Thermodynamics

Introducing

Description

Programme (detailed content) :
Introduction: The fundamental mathematical tools of thermodynamics: partial derivatives, Jacobian, exact and inexact total differential, Legendre transformation, notion of extensive and intensive quantities, integrating factor.

I - Part: The formalism of thermodynamics:
- Postulates for simple systems,
- Variables of state, equation of state of simple systems,
- Calorimetric coefficients of simple systems,
- Legendre transforms,
- Thermodynamic potentials, free energies of transformation, and their applications
- Stability conditions of simple systems,
- Order parameter, 1st and 2nd order phase transition.

II - Part: Applications
- thermal machines - balance and efficiency
- Perfect gases, Mixtures of perfect gases,
- Real gases, Van der Waals model
- Solid-liquid-vapour transformation of a simple system
- Changes of state,
- Phase diagram,

III - Part: Heat and matter transport phenomena
- Diffusion phenomena.
- applications: thermoelectric effects (Peltier, Seebeck, ...)

IV - Part : Thermodynamic model of the greenhouse effect.
- Modelling and influence of the atmosphere compositio

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
- The laws of thermodynamics, the notions of work, heat, energy associated with a transformation,
- The application to thermal machines, thermodynamic cycles, and the calculation of efficiency.
- This course is intended to provide students with an understanding of the laws of thermodynamics and the concepts of work, heat and energy associated with a transformation,
- simple phase diagrams and binary materials.
- This course is intended to provide students with the opportunity to learn more about the following topics: - The concepts of diffusion and heat/matter transport.

The student will have to integrate notions, contextualise them and then be able to decontextualise them to be able to project them into an adidactic situation.

Necessary prerequisites

Basics of mathematical analysis: functions of several variables, derivatives, integrations, differential equations.
General notions of thermodynamics of physical-chemical systems

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