UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Chimica Fisica Ambientale

2122-2-F7501Q051

Aims

To treat the main physical-chemical aspects related to the equilibrium distribution of compounds in various environmental compartments and extend the thermodynamic discussion to the study of non-equilibrium systems, in order to use the knowledge gained for the treatment of environmental systems.

Laboratory experiences will integrate the arguments discussed during the course.

Knowledge and understanding

At the end of the course the student knows:

- the thermodynamic quantities used for the description of partition equilibria of a compound between different phases and compartments;
- the equations describing the transport processes of matter, heat and momentum;
- the stability criteria of equilibrium states and stationary states, in a linear and non-linear regime.

Applying knowledge and understanding

At the end of the course the student is able to:

- predict the spontaneous evolution of the systems involved in processes of distribution of a compound between different phases and compartments and calculate the distribution at equilibrium;
- calculate the spatial and temporal evolution of species following diffusion processes;
- calculate the stability of the steady state of a system that is in conditions of non-equilibrium.

Making judgements

At the end of the course the student is able to:

- apply the thermodynamic description of equilibrium systems for the study partition processes;
- apply the thermodynamic description of non-equilibrium systems (in linear and non-linear regimes) for the study of transport processes and chemical reactivity.

Communication skills

Knowing how to describe in a technical report in a clear and concise manner the objectives, the procedure and the results of the laboratory experiments performed. Knowing how to present orally the topics proposed by the teacher with language properties .

Learning skills

Contents

Partitioning equilibria; Environmental thermodynamics; Transport processes

Detailed program

Thermodynamics aspects of partitioning processes. Real systems: fugacity and activity coefficients. Partitioning processes: vapour and liquid-gas distribution. Activity coefficients and solubility in water. Partitioning of compounds between different environmental compartments and phases.

Transport processes

Thermodynamics of non-equilibrium systems. Thermodynamic equilibrium and stability criteria. Non- equilibrium systems: the linear regime and the stationary states. Criteria for stability of stationary states. Systems far from equilibrium and stability criteria. Dissipative structures

Prerequisites

Thermodynamic of equilibrium systems

Teaching form

Textbook and teaching resource

Lecture notes of the teacher: U. Cosentino, Chimica Fisica Ambientale

Suggested textboks

P.W. Atkins, J. de Paula Physical Chemistry, 9a edition, 2011, Oxford University Press

Rene P. Schwarzenbach, R.P, Gschwend P.M., Imboden D.M., Environmental Organic Chemistry – 2003, second edition, Wiley

D. K. Kondepudi, I. Prigogine Modern Thermodynamics: From Heat Engines to Dissipative Structures, John Wiley & Sons Inc, 1998.

Semester

First semester

Assessment method

The exam consists of:

The final grade, expressed in thirtieths with possible praise, is given by the average of the two tests.

At the request of the student, the exam can be conducted in English.

Office hours

Every day, by appointment**.**