UCLouvain

lchm1211a

2023

Chimie générale 2

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Garcia Yann ;Leyssens Tom ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	It is recommended to have acquired the knowledge and skills developed in the teaching units: LCHM1111 Chimie générale LPHY1101 Physique 1 LPHY1102 Physique 2 *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	**0. INTRODUCTION TO PHYSICAL CHEMISTRY** Chemical equilibrium and partition coefficients. Applications. **1. THERMODYNAMICS** First principle of thermodynamics. Thermochemistry. Second principle of thermodynamics. Free Enthalpy. **2. PHASE EQUILIBRIA** Generalities. One-component systems: state diagram of a pure body. Thermodynamics and phase transition temperature. Phase rule. Two-component systems: binary phase diagrams. **3. CHEMICAL EQUILIBRIA IN SOLUTION** A/ Complements of acid-base equilibria and pH-metry. B/ Solubility and complexation. Complex reaction networks. Quantitative study of some cases. **4. COMPLEMENTS OF ELECTROCHEMISTRY** Electrolysis. Conductivity of solutions. Batteries. *Part 3A is not included in LCHM1211A.*
Learning outcomes	
Evaluation methods	Written examination at the end of the year, supplemented by continuous evaluation during the year (preparation of laboratory sessions and reports). Practical training is an integral and inseparable part of the general chemistry course. Participation in all **practical sessions** is therefore **MANDATORY**. The laboratories are taken into account in the final grade of LCHM1211 taken in deliberation. Any **REASONED** absence (justified by a medical certificate in case of illness, or by an official document in other cases) will result in the recovery of the missed session during the last week of the term. Any **NON-MOTIVATED** absence will in principle be sanctioned by **a NEGATIVE mark of 2 POINTS** on the final mark of LCHM1211 taken into account in the deliberation, and may, depending on the degree of recurrence and the assessment of the situation by the teaching staff, result in a non-negotiable final mark of **ZERO out of 20**. Should the number of unjustified and/or justified absences become significant, the teaching staff reserves the right to activate the articles of the RGEE allowing the jury to prohibit the student from registering for the corresponding exam.
Teaching methods	The course is a mixed course: lectures + podcasts. Teachers may ask students to work on certain parts of the course individually on the basis of podcasts available on moodle. Questions concerning these parts can be asked during the following lessons.
Content	I. Thermodynamics. First law of thermodynamics 1. Internal energy, work, heat. Conservation of total energy, first principle. Enthalpy. Molar heats. Global enthalpy balance with phase changes. Adiabatic transformation and calorimetry. Applications of the 1st principle to chemical transformations: Thermochemistry 2. Thermochemical equations: with heat balance. H and U are state functions. Hess's law. Standard enthalpies of formation. Standard enthalpy of combustion. Enthalpy of atomization. Binding enthalpy. Standard enthalpies of reaction. Thermochemistry of solutions. (DHf°) of ions in aqueous solution. Applications and illustrations of concepts (e.g. acid-base neutralization). Variation of DH with temperature. The second principle of thermodynamics 3. Entropy and disorder. Spontaneity. Standard entropy as a function of temperature. Standard entropy of reaction. Microscopic interpretation of entropy. Global change in entropy. Free enthalpy 4. Definition. relationship with spontaneity. Standard free enthalpy of formation. Standard free enthalpy of reaction. Influence of temperature on spontaneity. Non-spontaneous reaction becoming spontaneous at another temperature. Applications and illustrations (e.g. Ellingham diagrams for oxide reduction). Chemical and thermodynamic equilibrium 5. Entropy

	of mixing. Link with the equilibrium constant. Reaction of equilibria to changing conditions. Van't Hoff relation: influence of T on K. II. Phase balances. General 1. Definitions: physical states of matter, phase, constituents. One-component systems: state diagram of a pure body 2. P-T diagrams of a one-component system. Link between thermodynamics and one-constituent phase diagram. Gibbs phase rule. Examples of one-component P-T diagrams (H2O, CO2, ..). Multi-component systems III. Chemical equilibriums in solution. A/ Additional acid-base balances and pH-metry: mono-functional solutes, introduction to polyfunctional solutes. B/ Solubility. Ksp, solubility of a salt. IV. Complements of electrochemistry. Reminders on electrochemical cells: electrolysis and batteries. Notions of electricity. electrolysis 1. General principle. Faraday's laws. Reactions to electrodes and industrial applications. The conductivity of solutions 2. Principles and definitions. Ion mobility. Experimental aspect. Transport numbers and balance of an electrolysis. Applications: Degree of dissociation of weak electrolyte. Ionic product of water. Determination of a solubility product. Conductometric titrations. Batteries, or galvanic cells 3. Reminders: electromotive force of a battery, standard electrode potential and Nernst relation, energy balance of the battery. Main electrode types: metal-metal ion electrodes, metal-insoluble salt electrodes, gas electrodes, redox electrodes. Analytical applications: pH measurement, potentiometric titrations, commercial batteries etc. Laboratory sessions (3x3h30): Each student individually prepares and carries out an experiment illustrating a theme of the course. He writes a report. A laboratory manual allows the student to prepare each laboratory session. A check of this preparation takes place at the beginning of each session. Exercise sessions (6 x 2h): Solving theoretical problems and numerical exercises in the presence of assistants.
Inline resources	Moodle UCLouvain
Bibliography	Livre de P. Atkins, L. Jones et L. Laverman : "Principes de Chimie", Trad. Française de A. Pousse (De Boeck), ou édition anglaise originale correspondante, complété par des notes de cours. Manuel de travaux pratiques et fascicule d'exercices. Documents fournis sur Moodle.
Faculty or entity in charge	CHIM

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Bioengineering	BIR1BA	5	LBIR1140 AND LBIR1170	🔍