

6.0 credits

30.0 h + 30.0 h

2q

Teacher(s) :	Legras Roger (coordinator) ; Godard Pierre ; Nysten Bernard ;
Language :	Français
Place of the course	Louvain-la-Neuve
Main themes :	<p>Main themes</p> <p>Three general topics will be presented :</p> <ul style="list-style-type: none"> - the structure of atoms, the periodicity of atomic properties, intra- and inter-molecular bonds and how they control the structure of materials (~2,5 ECTS) ; - an introduction to thermodynamics within the frame of chemical equilibrium, in a rigorous way but without necessarily using the complete formalism of thermodynamics. This includes state variables, the first principle of thermodynamics (energy conservation, internal energy, enthalpy, heat and enthalpy of reaction), the second principle of thermodynamics (spontaneous and non-spontaneous processes, entropy), free energy (including its interest to describe equilibrated reactions and its link to equilibrium constants). The notion of perfect gas will also be introduced rapidly; (~2,5 ECTS) - how these notions are of interest to understand typical physical or chemical equilibria, such as acid/base reactions and one-component phase transformation (melting/crystallization and evaporation/condensation); these examples will be worked on further in practical lab experiments. (~1 ECTS).
Aims :	<p>To learn and to understand the bases of physical chemistry, which includes the structure of atoms and molecules, and the two first principles of thermodynamics. To use these principles to solve simple problems involving chemical reactions and/or phase changes. To be able to illustrate these concepts by simple experiments. To understand the principles of experimental science, and to be able to make links between experiments, theory and models.</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p>
Content :	<p>Table of contents</p> <ul style="list-style-type: none"> - Generalities: matter, compounds, molecules, atoms ; measurement units ; energy. - Atoms: Discovery of electrons, protons, neutrons ; periodic table of elements ; light as a wave and emission spectra ; Bohr model, orbitals, quantum numbers, atomic radius ; energy of ionization. - Chemical bonds: types, Lewis structure, electronegativity, bond energy. - Thermochemistry : work, energy, first principle, enthalpy, heat of reaction, of formation, of phase change, Hess' law, mass balances. - Second principle of thermodynamics : spontaneous and equilibrated reactions, heat transfer, Boltzmann principle, reaction entropy, Gibbs' free energy, phase changes. - Reaction equilibrium and free energy. Equilibrium constant, acid-base equilibrium, pH (weak and strong acids, salts, buffers, bases). pH computation, titration. <p>Methods will favor active learning techniques. The specific methods are left to the teachers to decide, within the general pedagogical frame set by the EPL. The course will include a few laboratory classes (practicals).</p>
Other infos :	<ul style="list-style-type: none"> - No prerequisite. - Student evaluation comprises a mid-semester evaluation and a final written exam. The final score results from the two evaluations according to EPL-set rules. - Lecture notes: <p>Copies of slides will be made available.</p> <p>A reference book will be proposed.</p>
Cycle and year of study :	> Bachelor in Engineering > Master [120] in Environmental Science and Management
Faculty or entity in charge:	BTCI