UCLouvain

lepl1302

2023

Chemistry and Physical chemistry 2

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	. SOMEBODY ;Jeanmart Hervé ;Proost Joris ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	This course assumes that you have acquired the notions of chemistry and physics (in particular the first and second principles of thermodynamics, reaction equilibrium and free energy as well as equilibrium in the aqueous phase) as taught in the course LEPL1301.
Main themes	The course is structured around four themes: the notion of ideal gas which is approached from an empirical point of view and via the kinetic theory of gases. the first (open and closed systems) and second principles of thermodynamics which make it possible to formalize in a rigorous framework the intuitive notions of conservation of energy, order/disorder and free energy. The chemical equilibria in the gaseous and aqueous phase which illustrate particularly well also all the power of thermodynamics. Applied to reaction mechanisms in an aqueous medium, thermodynamic concepts make it possible to understand and study the phenomena of solubility, chemical precipitation, redox balances and more particularly the electrochemical reactions of everyday life. Chemical kinetics called to rigorously describe the concepts of reaction rate, reaction order, activation energy and to highlight the molecular origin of these concepts.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 At the end of this course, the student will be able - to apply in theoretical developments and simple applications the law and the properties of ideal gases based in particular on the developments of the kinetic theory of gases. - to define and apply within the framework of simple exercises pertaining to open and closed systems the first principle of thermodynamics for systems of constant composition. - mathematically define and apply the concept of entropy in connection with heat exchange. In particular, the student will be able to expose and use the consequences of the existence of entropy for cycles. - to apply the principles of thermodynamics to systems whose composition is variable (chemical reactions) based on the notions of chemical potential, chemical equilibrium and standard enthalpy of reaction. - to describe and calculate the state of an oxidation-reduction reaction in an electrochemical cell as well as the impact of a change in parameters (concentrations, etc.) on the electromotive force. - to explain the concept of speed and order of a global chemical reaction or extracted from a reaction mechanism. - to link kinetics and equilibrium for elementary reactions. With regard to the AA reference of the program “Bachelor in Engineering Sciences, orientation civil engineer”, this course contributes to developing the AAs of the following program: - Axis 1 (AA 1.1, 1.2 and 1.3): base of scientific and technical knowledge - Axis 2: documenting and summarizing the state of current knowledge in the field considered (AA 3.1). - Axis 4: collectively commit to a work plan, a timetable and the roles to be played (AA 4.2). - Axis 5: make a convincing presentation using modern communication techniques (AA 5.6).

Evaluation methods	Students are assessed individually and in writing. The questions in the written examination are formulated to test the above-mentioned disciplinary learning outcomes. This written examination is based on the answer to questions related to the understanding of the theory as well as to the ability to solve exercises of the same type as those proposed or available during the course activities. A written examination may also be organised to test the disciplinary knowledge acquired towards the middle of the term. For the January session, the mark of this examination counts for one third of the final mark, provided that the result is higher than the mark of the examination alone. Finally, other forms of certification activities can be set up during the term. The laboratory mentioned below is an example. The examination consists of three parts: - open questions in chemistry (equilibria, kinetics, etc.) - open questions in thermodynamics (thermal cycles, etc.) - a MCQ on the whole subject The final mark is a weighted average of the marks obtained in the various parts. Depending on the length of the examination, the weighting is 1/3, 1/3, 1/3 (4 hours of examination) or 0.375, 0.375, 0.25 (3 hours of examination). If the average out of 20 is between 9.01 and 9.99, the mark is rounded up to 9. Active participation in the compulsory laboratories is also assessed and included in the grade for the "chemistry" part (Prof. Proost's part) of the course. An unjustified absence from the laboratory(s) will result in an absence mark for the examination. The subject matter of the examination includes everything that has been said or shown in the course orally, on screen or by means of other media, and is therefore not limited exclusively to the "course material". For the August/September session, the examination is no longer taken into account. The final grade will be a weighted average of the examination grade and the laboratory grades.
Teaching methods	The course consists of 12 lectures, 10 tutorials (APE), and one or two laboratories. For the lab sessions, an information session is organised beforehand to explain its content, its objectives and its evaluation. This course also addresses issues related to sustainable development and transition through the following activities: - practical work (laboratories) on the electrochemical production of H2 via the electrolysis of water. In the explanatory note for the labs, students are given more details on the role of green H2 in the energy transition. During the labs, they are also invited to think about improvements to the H2 production process to reduce its energy consumption. - exercises on topics related to the transition. Many of the themes in the course are energy-related and lend themselves to applications relevant to the transition. This helps to anchor the subject matter in a current context.
Content	- ideal gases and kinetic theory of gases - complements on the first principle of thermodynamics and application to thermal cycles - first principle for open systems - second principle of thermodynamics applied to thermal cycles - chemical kinetics - chemical equilibrium - electrochemical equilibrium - phase equilibria
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=8134
Other infos	Participation to the laboratories is mandatory. These are organized only once during the semester. It is impossible to redo them later in the year.
Faculty or entity in charge	BTCI

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Engineering	FSA1BA	5		🔍