UCLouvain

linge1115

2026

Chemistry and environement I

6.00 credits	50.0 h + 10.0 h	Q1

Teacher(s)	Filinchuk Yaroslav ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	No prerequisites. This course is reserved for enrolled students.
Main themes	The course aims to provide students with the fundamental principles of chemistry so that they can understand the language of chemistry, the states of matter, and the relationships between the nature, structure, and properties of chemical compounds. A part of the course will be dedicated to the role of chemistry in the energy transition. This course explores the fundamental principles of chemistry, starting with the structure of the atom, elements, and isotopes, as well as concepts related to the periodic table. An introduction to nuclear energy, including fission, fusion, nuclear power plants, and nuclear weapons, is also included. A four-quantum-number atomic model is detailed, along with chemical bonding. The block on the structure of matter concludes with the concepts of isomerism and crystallography, also covering major research facilities such as synchrotrons and neutron sources. The chosen themes will include the concept of equilibrium, illustrated by ammonia synthesis, as well as acids and bases. Chemical kinetics will lead us to reaction mechanisms and catalysis, which are crucial in industry. Thermochemistry will be introduced, paving the way for a discussion on the energy transition. Concepts related to energy sources, alternative energies, and energy storage will offer a contemporary perspective on practical applications of chemistry. Redox reactions will be covered, introducing us to electrochemistry, energy storage in batteries, the use of fuel cells, and industrial electrolysis. At the end of the course, experimental demonstrations will be presented, including spectacular experiments.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 **Understanding of Fundamental Chemistry Basics**: Students will be able to comprehend and use the language of chemistry, including the structure of atoms, elements, and isotopes, as well as the fundamental concepts of the periodic table. **Analysis of Relationships between Structure, Nature, and Chemical Properties**: Students will master the connections between molecular structure, the nature of chemical compounds, and their properties by exploring concepts such as chemical bonding, isomerism, and crystallography. **Knowledge of Energy Phenomena Related to Chemistry**: Students will be able to explain the principles of nuclear energy (fission, fusion) and understand their role in nuclear power plants as well as in military applications. **Application of Chemical Equilibrium and Kinetics Concepts**: Students will be able to analyze chemical equilibria (such as the synthesis of ammonia), understand reaction mechanisms, and recognize the importance of catalysis in industrial processes. **Mastery of Thermochemistry and Energy Transition Concepts**: Students will gain a thorough understanding of thermochemistry principles, alternative energy management, and energy storage, offering a perspective on contemporary energy transition issues. **Exploration of Redox Reactions and Electrochemistry**: Students will be able to apply redox concepts to practical technologies such as batteries, fuel cells, and industrial electrolysis. **Experimental Observation and Analysis**: Through experimental demonstrations, students will develop their scientific curiosity and ability to interpret complex chemical phenomena in practical and visual contexts. The contribution of this UE to the development and mastery of the skills and learning outcomes of the program(s) is accessible at the end of this sheet under the section "Programs/Courses Offering this Teaching Unit (UE)." In relation to the LSM Compass, the targeted competencies are: Knowledge and reasoning, Scientific and systemic approach, Corporate citizenship. In relation to the Transition Wheel, the targeted competencies are: Scientific knowledge and approach, Systemic Analysis.

Evaluation methods	**Skills to be acquired:** Understanding the basics of general chemistry, structure and properties of matter, chemical reactions and importance of chemistry in many areas. **Evaluation:** - There is a written exam counting for 20 points. These are basically the exercises applied to the theoretical course. These exercises are of the same style as those made in exercise sessions during the year. Theoretical questions also make a part of the examination.- The mid-term examination provides 1 point to the final examination score. The result of the mid-term examination is transferred to the June and August exam sessions but not to the next academic year.
Teaching methods	The course is taught with the use of PowerPoint slides, available at Moodle. Exercises are provided to facilitate the understanding. The course will be illustrated with examples taken from everyday life in the living world and in industry.
Content	Fundamental concepts of chemistry. Introduction to the periodic table. Stoichiometry, concentration. The gas laws. Energy, heat, thermochemistry; the first law of thermodynamics, enthalpy. Quantum numbers, orbitals. Chemical bonds: ionic, covalent, intermolecular. Molecullar geometry, hybridization of orbitals. The rate and the mechanism of reactions, influence of catalysts. Chemical equilibrium, predicting the direction of a reaction; equilibrium constant. Chemical reactions in solution, strong and weak electrolytes. Acid-base reactions, pH and concentration of hydronium ions; titration. Solubility and precipitation, the solubility product, the common-ion effect. Oxidation and reduction, redox equations. Introduction to electrochemistry, electrochemical cells and electrolysis.
Bibliography	Un livre de référence est conseillé: - **Principes de chimie, une approche moléculaire**, Nivaldo Tro, une adaptation de Eveline Clair, Julie Vézina, Pearson Education, 2015. Un autre livre peut être aussi recommandé: - Principes de chimie, Atkins, Jones, Laverman, de Boeck, 4eme édition, 2017.
Other infos	Teaching material: - Slides of the presentations (available online on Moodle) - The excercises workbook (available online on Moodle) - The book "Principes de chimie, une approche moléculaire", Nivaldo Tro, une adaptation de Eveline Clair, Julie Vézina, Pearson Education, 2015 (ISBN 978-2-7613-7248-0).
Faculty or entity in charge	ESPO

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Interdisciplinary Advanced Master in Science and Management of the Environment and Sustainable Development	ENVI2MC	5		
Bachelor : Business Engineering	INGE1BA	6		