Module summary
Fundamentals of general chemistry

Description of learning outcomes for module

<table>
<thead>
<tr>
<th>MLO code</th>
<th>Student after module completion has the knowledge/knows how to/is able to</th>
<th>Method of learning outcomes verification (form of completion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social competence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_K001</td>
<td>Student should acquire the ability to perform experimental work in the form of team work and should improve his ability to discuss using scientific English</td>
<td>Activity during classes, Execution of exercises, Involvement in teamwork, Report</td>
</tr>
<tr>
<td>Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_U001</td>
<td>Student should be capable to perform simple chemical experiment and to be familiar with basic laboratory glassware, equipment and procedures</td>
<td>Completion of laboratory classes, Execution of laboratory classes</td>
</tr>
<tr>
<td>M_U002</td>
<td>Student should enrich his professional chemical vocabulary in English</td>
<td>Activity during classes, Examination, Participation in a discussion, Report</td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_W001</td>
<td>Student should acquire general knowledge on the matter and its structure and should understand the fundamental principle of chemical processes</td>
<td>Activity during classes, Examination, Execution of laboratory classes, Report</td>
</tr>
<tr>
<td>M_W002</td>
<td>Student should know the basics of chemistry of solutions, gases and solids.</td>
<td>Examination, Report</td>
</tr>
<tr>
<td>M_W003</td>
<td>Student should understand the principles of chemical kinetics.</td>
<td>Examination</td>
</tr>
</tbody>
</table>
FLO matrix in relation to forms of classes

<table>
<thead>
<tr>
<th>MLO code</th>
<th>Student after module completion has the knowledge/ knows how to/is able to</th>
<th>Form of classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lectures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>M_K001</td>
<td>Student should acquire the ability to perform experimental work in the form of team work and should improve his ability to discuss using scientific English</td>
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<td>Skills</td>
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<td></td>
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</tr>
<tr>
<td>M_W003</td>
<td>Student should understand the principles of chemical kinetics.</td>
<td>-</td>
</tr>
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</table>

Module content

Lectures
The course is designed to give basics of modern chemistry and the structure of matter, elements, chemical bonds, molecules, properties of matter and chemical reactions. General foundations to inorganic and organic chemistry are given. Introduction to the nature of matter. Classification of chemical substances. Chemical elements and compounds. Substances and mixtures. The three states of matter. Physical and chemical properties of matter. Fundamental chemical laws. Law of mass and energy conservation. Atomic structure. The electron and nucleons. Atomic number, mass number, structure
of nucleus. Isotopes, their natural abundance, atomic weight. Nuclear interactions and
Nuclear power plant and nuclear bomb.
Principle of wave mechanics. Radiation. The Heisenberg’s uncertainty principle. The de
Broglie’s hypothesis. Planck’s quantum theory. Rutherford’s (nucleus), Thompson’s (electron) and Thompson’s (electron charge) experiments. Photons and electrons.
Wave function and its physical meaning.
The electron structure of hydrogen atom. The Schrödinger’s equation – wave equation.
The movement of electron in the nucleus potential electrostatic field. Application of
wave mechanics to hydrogen atom. The solutions of Schrödinger’s equation. Wave
Periodic Table. Energy levels in atom; the Pauli’s exclusion principle, Hund’s rule..
Chemical reaction. The chemical bond – electronic theory. Molecule. The theory of
molecular orbitals. Types of molecular orbitals.
Homonuclear diatomic molecules – electronic configuration of H2, O2, N2, Cl2
molecules.
diagrams for homo and heteronuclears molecules.
Mathematical and physical sense of hybridisation. The symmetry of molecule.
Chemical reaction, chemical equation. Chemical kinetics. The rate of the reaction.
The rate laws. The mechanism of a chemical reaction.
Chemical and physical processes. The concept of chemical equilibrium.
Equilibrium constant. Le Chatelier’s principle.
The liquid state. The structure and properties of water. Phase changes, phase
equilibrium, phase diagram of water. Gibbs’ principle.
Solvent – solution interaction, concentration, units. Types of solutions. Solubility.
Electrolytes and non-electrolytes. Osmosis, osmotic pressure. Semipermeable
membranes. Ionization, solvation. Water as a solvent. Autoionization of water. The ion
product constant. The ion product of water, pH factor, a measure of acidity.
theory of acids and bases.
Criteria of strong and weak electrolytes. Percent ionization, ionization constant. Salts.
Hydrolysis. Buffer solutions.
Oxidation-reduction. Degree of oxidation. Red-ox reactions. Introduction to
electrochemistry. Nernst equation for electrode potential. Electrolysis. Electrochemical
cell. Electro-Motor-Force (EMF) for the cell.
Metallurgy and the chemistry of metallurgical processes. Chemical and
electrochemical processes in metallurgy. Iron and steel making. Aluminium, copper,
alkali metals.
Gases. The gas laws. The ideal gas equation. Deviations from ideal behavior. Surface
active substances. Surfactants and detergents.

**Laboratory classes**

1. Organisational meeting. Rules and procedures in chemical labs. Handling with
chemicals, lab. equipment and glass. Introduction to Exercises 1. New vocabulary.


**Method of calculating the final grade**

EG - Exam Grade  
LG - Laboratory Grade  
Final Grade = 0.5 EG + 0.5 LG

**Prerequisites and additional requirements**

No prerequisites for foreign students. Fluency in spoken English and understanding. Suggested requirement for Polish students: previous completion of General Chemistry course in Polish.

**Recommended literature and teaching resources**

Raymond Chang, Chemistry, McGraw-Hills 1998 or later editions  
Linus Paulin, Peter Pauling, Chemistry

**Scientific publications of module course instructors related to the topic of the module**


Concentrations of 137Cs and 40K radionuclides and some heavy metals in soil samples from the eastern part of the Main Ridge of the Flysch Carpathians / Barbara KUBICA, Katarzyna SZARŁOWICZ, Marcin STOBİŃSKI, Stefan Skiba, Wiolet RECZYŃSKI, Janusz GOŁAŚ // Journal of Radioanalytical and Nuclear Chemistry (Print) ; ISSN 0236-5731. — 2014 vol. 299 iss. 3, s. 1313–1320. — Bibliogr. s. 1319–1320, Combined method of solid-phase extraction and GC-MS for determination of acidic, neutral, and basic emerging contaminants in wastewater (Poland) / Katarzyna NOSEK, Katarzyna STYSZKO, Janusz GOŁAŚ // International Journal of Environmental Analytical Chemistry ; ISSN 0306-7319. — 2014 vol. 94 no. 10, s. 961–974.

Evaluation of sorption behaviour of selected pharmaceutical compounds in sediments from Dobczyce reservoir / Katarzyna NOSEK, Katarzyna STYSZKO, Janusz GOŁAŚ // W:

Determination of acidic pharmaceuticals in municipal wastewater by using solid-phase extraction followed by gas chromatography-mass spectrometry / Katarzyna NOSEK, Katarzyna STYSZKO, Janusz GOŁAŚ // Geomatics and Environmental Engineering ; ISSN 1898-1135. — Tytuł poprz.: Geodezja oraz Inżynieria Środowiska. — 2012 vol. 6 no. 3, s. 45–60. — Bibliogr. s. 57–60.

Chemistry of sediments from the Dobczyce Reservoir, Poland, and the environmental implications / Witold RECZYŃSKI, Małgorzata JAKUBOWSKA, Janusz GOŁAŚ, Andrew Parker, Barbara Kubica // International Journal of Sediment Research ; ISSN 1013-7866. — błędny ISSN 1001-6279. — 2010 vol. 25 no. 1, s. 28–38.

Additional information

None

Student workload (ECTS credits balance)

<table>
<thead>
<tr>
<th>Student activity form</th>
<th>Student workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact hours</td>
<td>56 h</td>
</tr>
<tr>
<td>Examination or Final test</td>
<td>2 h</td>
</tr>
<tr>
<td>Preparation for classes</td>
<td>24 h</td>
</tr>
<tr>
<td>Realization of independently performed tasks</td>
<td>40 h</td>
</tr>
<tr>
<td>Preparation of a report, presentation, written work, etc.</td>
<td>35 h</td>
</tr>
<tr>
<td>Participation in study tours</td>
<td>20 h</td>
</tr>
<tr>
<td>Summary student workload</td>
<td>177 h</td>
</tr>
<tr>
<td>Module ECTS credits</td>
<td>7 ECTS</td>
</tr>
</tbody>
</table>