MODULE DESCRIPTION (SYLLABUS)

1.	Module: **General and Inorganic Chemistry**
2.	Language of instruction: **English**
3.	Faculty **Faculty of Biotechnology**
4.	Course/module code: **29-BT-S1-E1-EnGICH** (Lect.) **29-BT-S1-E1-EnGICHc** (Lab.)
5.	Course/module type (*mandatory* or *elective*): **mandatory**
6.	Programme: **Biotechnology**
7.	Study cycle (*1st/2nd*): **1st cycle**
8.	Year: **1st**
9.	Semester *(autumn* or *spring):* **autumn**
10.	Form of tuition and number of hours: Lecture: **30 h** Laboratory: **30 h**
11.	Coordinator(s): Lect.: **Adam Jezierski, Prof.** Lab.: **Michał Kobyłka, PhD**
12.	Initial requirements *(knowledge, skills, social competences):* **Basic knowledge of chemistry, high school/secondary school level.**
13.	Objectives: **Passing the knowledge necessary to understand the natural processes and phenomena.** **Shaping the understanding of mechanisms that stand behind various chemical reactions, differentiation of various reaction types.** **Introduction to the nomenclature of inorganic compounds.** **Passing on the basic theoretical concepts of coordination chemistry, and developing the ability of using them in predicting the structure and reactivity of metal complexes.** **Introduction to independent laboratory work and critical interpretation of results.**

	Introduction to the basic concepts and rules of analytical chemistry. **Introduction to the basics of laboratory practice.**
14.	Content: Lect.: **Basics of quantum mechanics, the wave function, energy levels of atoms and molecules.** **Explanation of the periodic table of the elements based on quantum numbers.** **Behavior of elements within periods and groups.** **Chemical bonding – covalent, ionic, metal and hydrogen bonds – conditions of forming, stability.** **Relationships between chemical bonding and macroscopic, thermodynamic properties.** **Symmetry of molecules.** **Molecular interactions and their relationship to gas phase, liquid phase and solid state properties.** **Chemical equations. Basic types of chemical reactions – acid-base reactions, reduction-oxidation reactions, organic chemistry reactions (addition, substitution and elimination). Chain reactions. Stoichiometry.** **Basic chemical calculations. Solutions and solvents.** **Basic concepts of chemical thermodynamics, reaction heat, enthalpy, entropy, Gibbs free energy.** **Chemical equilibrium, reversible and irreversible reactions, examples from geochemistry, biochemistry, industrial processes and common-day applications.** **Basic concepts of chemical kinetics.** **Catalysts and catalysis.** **Reactions of radicals.** **Basics of organic chemistry – vital types of organic molecules and their characteristic reactions.** **The carbon cycle. Photosynthesis as a chain of consecutive photochemical and redox reactions of organic compounds; energetics of photosynthesis.** **Examples of element cycles in nature – geochemical processes.** **Modern chemical analysis: spectroscopy (IR, UV-Vis, NMR, EPR), electrochemistry, chromatography – theoretical background and applications.** Lab.: **General rules and safety regulations for work in the chemical laboratory.** **Concentration of hydrogen ions and pH indicators.** **Buffer solutions.** **Qualitative analysis of inorganic compounds.** **Classical quantitative analysis: acid-base titration, redox titration and complexometric**

	titration.	
15.	Learning outcomes: Student: • **comprehends the basic chemical laws and concepts that apply to the microscopic scale, and should be able to illustrate them by appropriate examples,** • **is able to connect the physical properties to molecular structure,** • **has the necessary knowledge to comprehend the common natural phenomena,** • **is able to apply chemical calculations in every-day laboratory practice, know how to properly handle experimental data, and be able to list examples of situations where these skills are commonly used,** • **knows the physicochemical properties of selected compounds and know the basic rules of handling chemicals, and laboratory hygiene and safety.** • **is able to define and explain basic laws and concepts of chemistry,** • **is able to apply the rules that govern handling chemicals and laboratory safety,** • **is able to use basic laboratory equipment and perform basic laboratory activities,** • **is able to identify the various factors that can influence the outcome of conducted research, and should be able to find the main sources of experimental error,** • **knows to solve problems encountered during research, based on various resources.** • **is aware of his overall knowledge and understand the need of its constant improvement,** • **is able to work in a team environment, and be responsible for the tasks and duties placed upon him,** • **is able to use literature sources in order to find the necessary information,** • **is able to take responsibility for the safety of himself and others around him.**	Outcome symbols: K1_W04, K1_W07, K1_W10 K1_U01, K1_U05, K1_U06, K1_U07, K1_U11, K1_U12, K1_U13 K1_K01, K1_K02, K1_K03, K1_K05

<table>
<tr><td>16.</td><td>Recommended literature:

Steven S. Zumdahl, Chemical Principles, 6th Edition, Brooks/Cole, 2009

Kenneth W. Whitten, Raymond E. Davis, M. Larry Peck, George G. Stanley, Chemistry, Brooks/Cole, 2010

Leo J. Malone, Theodore Dolter, Basic Chemistry, 9th Edition International Student Version, Wiley, 2012</td></tr>
<tr><td>17.</td><td>Methods of verification of the assumed learning outcomes

• Lect.: written exam, optional oral examination for better notes
• Lab.: pre-lab tests, laboratory reports, mid-lab tests</td></tr>
<tr><td>18.</td><td>Conditions of earning credits:

• Active participation in laboratory classes
• Completion of the laboratory classes is based on pre-lab tests, mid-lab tests and laboratory reports
• Completion of the lecture is based on a written or oral exam</td></tr>
<tr><td rowspan="6">19.</td><td colspan="2">Student’s workload:</td></tr>
<tr><td>Activity</td><td>Number of hours for the activity</td></tr>
<tr><td>Hours of instruction (as stipulated in study programme) :
• Lect.: 30 h
• Lab.: 30 h</td><td>60 h</td></tr>
<tr><td>Student’s own work:
• preparation before classes: 30 h
• writing reports: 10 h
• preparation for the final exam: 20 h</td><td>60 h</td></tr>
<tr><td>Total number of hours</td><td>120 h</td></tr>
<tr><td>Number of ECTS:

• Lect.: 3 ECTS
• Lab.: 2 ECTS</td><td>5 ECTS</td></tr>
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