

## Subject card

|                                             |                                                                                                                                               |                                                          |                                         |                                     |                                                                                                                      |            |     |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Repetitory in organic chemistry and biochemistry, PG_00054869                                                                                 |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Field of study                              | Chemistry                                                                                                                                     |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Date of commencement of studies             | October 2026                                                                                                                                  |                                                          | Academic year of realisation of subject |                                     | 2026/2027                                                                                                            |            |     |
| Education level                             | Master's studies                                                                                                                              |                                                          | Subject group                           |                                     | Obligatory subject group in the field of study<br>Subject group related to scientific research in the field of study |            |     |
| Mode of study                               | full-time studies                                                                                                                             |                                                          | Mode of delivery                        |                                     | at the university                                                                                                    |            |     |
| Year of study                               | 1                                                                                                                                             |                                                          | Language of instruction                 |                                     | English                                                                                                              |            |     |
| Semester of study                           | 1                                                                                                                                             |                                                          | ECTS credits                            |                                     | 3.0                                                                                                                  |            |     |
| Learning profile                            | academic                                                                                                                                      |                                                          | Assessment form                         |                                     | credit                                                                                                               |            |     |
| Conducting unit                             | Faculty of Chemistry -> Rector                                                                                                                |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                            |                                                          | prof. dr hab. Krzysztof Rolka           |                                     |                                                                                                                      |            |     |
|                                             | Teachers                                                                                                                                      |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Lesson types                                | Lesson type                                                                                                                                   | Lecture                                                  | Tutorial                                | Laboratory                          | Project                                                                                                              | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                         | 0.0                                                      | 30.0                                    | 0.0                                 | 0.0                                                                                                                  | 0.0        | 30  |
|                                             | E-learning hours included: 0.0                                                                                                                |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Learning activity and number of study hours | Learning activity                                                                                                                             | Participation in didactic classes included in study plan |                                         | Participation in consultation hours |                                                                                                                      | Self-study | SUM |
|                                             | Number of study hours                                                                                                                         | 30                                                       |                                         | 5.0                                 |                                                                                                                      | 40.0       | 75  |
| Subject objectives                          | Familiarize students with the main aspects of organic chemistry and classes of organic compounds.                                             |                                                          |                                         |                                     |                                                                                                                      |            |     |
|                                             | Familiarize students with main aspects of stereochemistry of organic compounds.                                                               |                                                          |                                         |                                     |                                                                                                                      |            |     |
|                                             | Familiarize students with types of organic reactions.                                                                                         |                                                          |                                         |                                     |                                                                                                                      |            |     |
|                                             | Familiarize students with basic bioorganic compounds and their role in metabolic pathways.                                                    |                                                          |                                         |                                     |                                                                                                                      |            |     |
|                                             | Familiarize students with importance and relationships of the metabolic pathways and their impact on living organism and natural environment. |                                                          |                                         |                                     |                                                                                                                      |            |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Subject outcome                                                                                                                                                                                                                                                                                                                    | Method of verification                                                                                                       |
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|                                 | [CHEMMU2_U01] Plans and implements chemical experiments of medium complexity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Students: present plainly – in both speech and writing – correct chemical argumentation; name and write structures and reactions of organic compounds, bio- and macromolecules, present and explain mechanisms of types of organic reactions, write chemical reactions of selected metabolic pathways                              | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report<br>[SU4] test/exam - oral or written |
|                                 | [CHEMMU2_U04] Applies acquired knowledge of chemistry and related scientific disciplines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Students: explain the relationships between metabolic pathways and their impact on the functioning of a living organism.                                                                                                                                                                                                           | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report<br>[SU4] test/exam - oral or written |
|                                 | [CHEMMU2_U03] Finds necessary information in specialist literature, databases and other sources, lists basic scientific journals in chemistry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Students: use available scientific literature to prepare a paper presented during classes.                                                                                                                                                                                                                                         | [SU1] oral statement/conversation/discussion                                                                                 |
|                                 | [CHEMMU2_K05] Understands the need for independent search of information in scientific literature and popular science magazines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Students: verify information available on websites.                                                                                                                                                                                                                                                                                | [SK1] oral statement/conversation/discussion<br>[SK2] presentation/project/paper/report<br>[SK4] test/exam - oral or written |
|                                 | [CHEMMU2_W04] Applies the acquired knowledge to an in-depth description of the properties of chemical connections, methods of their synthesis and analysis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Students: characterize the relationships between basic groups of biomolecules and basic metabolic pathways and understand their impact on the living organism in relation to the socio-economic aspects of life.                                                                                                                   | [SW4] test/exam - oral or written<br>[SW1] oral statement/conversation/discussion<br>[SW2] presentation/project/paper/report |
|                                 | [CHEMMU2_W01] Uses knowledge of spectroscopic methods of chemical compound analysis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Students: characterize physicochemical methods for examining the structures of biopolymers.                                                                                                                                                                                                                                        | [SW4] test/exam - oral or written<br>[SW1] oral statement/conversation/discussion<br>[SW2] presentation/project/paper/report |
|                                 | [CHEMMU2_W02] Has extended and in-depth knowledge in the field of basic chemistry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Students: define the structure and properties of organic compounds and bio- and macromolecules; understand the types of organic reactions, with particular emphasis on reaction mechanisms.                                                                                                                                        | [SW4] test/exam - oral or written<br>[SW1] oral statement/conversation/discussion<br>[SW2] presentation/project/paper/report |
|                                 | [CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Student: rozumieją potrzebę uczenia się, inspirować innych do nauki; współpracować w grupie, przyjmując różne role; wykazywać się kreatywnością w ustalaniu priorytetów niezbędnych do realizacji różnych zadań; Rozumieć społeczne aspekty praktycznego wykorzystania wiedzy i umiejętności oraz związaną z nimi odpowiedzialność | [SK1] oral statement/conversation/discussion<br>[SK2] presentation/project/paper/report<br>[SK4] test/exam - oral or written |
| Subject contents                | Structure and properties of organic molecules (hybridization, resonance, isomerism, acidity). Types of organic reactions (substitution, elimination, addition, oxidation-reduction, radical reaction). Structure, synthesis and reactions of alkanes, alkenes, alkynes, alkyl halides, aromatic compounds, alcohols, phenols, ethers, epoxides, aldehydes and ketones, carboxylic acids and their derivatives, amines. Chemical structure, physicochemical properties and biological functions of peptides, proteins, nucleic acids, phospholipids, mono- and polysaccharides, energy-rich compounds, thermodynamics of biochemical reactions. Selected metabolic pathways: glycolysis, gluconeogenesis, pyruvate decarboxylation, Krebs cycle, oxidative phosphorylation, glycogen metabolism, fatty acids metabolism, amino acids metabolism. |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                              |
| Prerequisites and co-requisites | Basic knowledge in organic chemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                              |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Passing threshold                                                                                                                                                                                                                                                                                                                  | Percentage of the final grade                                                                                                |
|                                 | Positive note from a written exam consisting of 10 open questions and an evaluation of the student's activity during classes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 51.0%                                                                                                                                                                                                                                                                                                                              | 100.0%                                                                                                                       |

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| Recommended reading                                            | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | L. G. Wade Jr., Organic chemistry,<br><br>J. McMurry Organic chemistry<br><br>J. M. Berg, J. L. Tymoczko, L. Stryer, Biochemistry, |
|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Various academic handbooks concerning organic chemistry and biochemistry                                                           |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                    |
| Example issues/<br>example questions/<br>tasks being completed | <p>1. Draw the Lewis structure for each compound. Label the hybridization, geometry, and bond angles around each atom other than hydrogen. a) acetic acid   b) 3-butene-2-one   c) aniline   d) dimethyl ether</p> <p>2. All of the following compounds can react as acids. Rank them in order of increasing acidity. Explain your ranking.</p> <p><math>\text{CH}_3\text{CH}_2\text{OH}</math>, <math>\text{CH}_3\text{CH}_2\text{SO}_3\text{H}</math>, <math>\text{CH}_3\text{CH}_2\text{COOH}</math>, <math>\text{CH}_3\text{CHClCOOH}</math>, <math>\text{ClCH}_2\text{CH}_2\text{COOH}</math></p> <p>3. The reaction of 2-bromo-2-methylpropane heated in a mixture of methanol and <math>\text{H}_2\text{O}</math> gives three main products. Define the products and discuss the mechanisms leading to each of them.</p> <p>4. Define glycolysis and explain its role in the generation of metabolic energy.</p> <p>5. Describe the structures and biological roles of glycogen, starch, amylose, amylopectin and cellulose</p> <p>6. Outline the role of the dihedral angles of the polypeptide main chain in formation of protein secondary structure. List examples of canonical secondary structures.</p> <p>7. Explain why triacylglycerols are highly concentrated form of stored metabolic energy.</p> <p>8. Describe the structures and biological roles of DNA and RNA.</p> |                                                                                                                                    |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                    |

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