

## Subject card

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| Subject name and code                       | Environmental chemistry, PG_00103534                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |                                         |                                     |                        |            |     |
| Field of study                              | Environmental Protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                          |                                         |                                     |                        |            |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                          | Academic year of realisation of subject |                                     | 2027/2028              |            |     |
| Education level                             | Bachelor's studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          | Subject group                           |                                     | Optional subject group |            |     |
| Mode of study                               | full-time studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          | Mode of delivery                        |                                     | at the university      |            |     |
| Year of study                               | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          | Language of instruction                 |                                     | Polish                 |            |     |
| Semester of study                           | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          | ECTS credits                            |                                     | 2.0                    |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                          | Assessment form                         |                                     |                        |            |     |
| Conducting unit                             | Department of Environmental Analysis -> Faculty of Chemistry -> Rector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          |                                         |                                     |                        |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          | dr hab. inż. Anna Białk-Bielińska       |                                     |                        |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                          |                                         |                                     |                        |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Lecture                                                  | Tutorial                                | Laboratory                          | Project                | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 30.0                                                     | 0.0                                     | 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                                 |                        | 15.0       | 50  |
| Subject objectives                          | <ul style="list-style-type: none"><li>• To become familiar with the basic issues of environmental chemistry, including the chemical processes occurring in its various components;</li><li>• To develop the ability to independently assess factors relevant to chemical processes occurring in the environment;</li><li>• To familiarize with the main environmental pollutants;</li><li>• To develop the ability to assess the exposure of various components of the environment to the presence of chemical compounds and the effects that this presence brings;</li><li>• To familiarize with methods of preventing the harmful effects of chemical compounds in the environment;</li></ul> |                                                          |                                         |                                     |                        |            |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Subject outcome                                                                                                                                                                                                          | Method of verification                       |
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|                                 | [OŚL3_W02] Characterises the relationships and relationships between various disciplines of natural sciences and science, uses knowledge of mathematics, physics, chemistry and biology in the description of basic concepts, concepts and principles in environmental protection.                                                                                                                                                                                                                                                         | Able to assess the exposure of individual environmental components to the presence of chemical compounds depending on the manner and scale of their use, using appropriate information tools as well as literature data. | [SW4] test/exam - oral or written            |
|                                 | [OŚL3_U08] Correctly concludes based on the available data from various sources.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Draws correct conclusions from the available literature data as well as the obtained experimental results.                                                                                                               | [SU4] test/exam - oral or written            |
|                                 | [OŚL3_W10] Describes the principles of environmental protection based on basic legal regulations and instruments of applying law in environmental protection and from the point of view of economy and management of environmental resources; enumerates general aspects of the economic activity of entities.                                                                                                                                                                                                                             | Knows the basic regulations on the management of chemical substances and their environmental risk assessments.                                                                                                           | [SW4] test/exam - oral or written            |
|                                 | [OŚL3_W08] Explains the mechanisms of economic and consumer pressure on the environment and recognises the possibilities of reducing it using the latest knowledge and scientific achievements.                                                                                                                                                                                                                                                                                                                                            | Understands the relationships associated with the ecotoxicity of selected environmental pollutants and characterizes the methods used to assess it.                                                                      | [SW4] test/exam - oral or written            |
|                                 | [OŚL3_W05] Explains the course of natural and anthropopressional physical, chemical and biological processes and phenomena occurring in nature at various levels of matter organisation.                                                                                                                                                                                                                                                                                                                                                   | The student correctly solves tests and answers open questions on the knowledge of environmental chemistry.                                                                                                               | [SW4] test/exam - oral or written            |
|                                 | [OŚL3_W09] Describes the basic methods, techniques and tools that allow the rational use, shaping and restoration of natural resources.                                                                                                                                                                                                                                                                                                                                                                                                    | Identifies preventive measures for the harmful effects of selected chemical compounds on various components of the environment and human health.                                                                         | [SW4] test/exam - oral or written            |
|                                 | [OŚL3_K05] Identifies the level of her/his knowledge and skills, demonstrates the need to update knowledge about the environment and its protection, demonstrates the need for continuous professional training and personal development.                                                                                                                                                                                                                                                                                                  | The student is able to define gaps in his knowledge and fill them by searching and citing the literature on the subject, thereby understanding the need for further education.                                           | [SK1] oral statement/conversation/discussion |
|                                 | [OŚL3_U04] Uses specialist language in the discussion and properly uses the nomenclature in the field of environmental protection and individual disciplines related to it.                                                                                                                                                                                                                                                                                                                                                                | Discusses issues of environmental chemistry in understandable language, using correct nomenclature.                                                                                                                      | [SU4] test/exam - oral or written            |
| Subject contents                | Lecture topics: chemistry of the lithosphere, hydrosphere and atmosphere, including: the cycle of matter and biogeochemical cycles (C, N, O, P, S); basic environmental problems (acid rain, greenhouse effect, smog, ozone hole); environmental pollutants (sources and their fate, effects of presence); selected physicochemical properties of chemicals vs. predicting their environmental fate; the concept of environmental risk; ecotoxicological studies in assessing the effects of the presence of chemicals in the environment. |                                                                                                                                                                                                                          |                                              |
| Prerequisites and co-requisites | Knowledge of the basics of general, inorganic, organic and analytical chemistry including: the structure and physicochemical properties of basic groups of organic and inorganic compounds, knowledge of chemical nomenclature, ability to apply basic formulas from stoichiometry, calculation of solution concentrations.                                                                                                                                                                                                                |                                                                                                                                                                                                                          |                                              |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Passing threshold                                                                                                                                                                                                        | Percentage of the final grade                |
|                                 | Written exam with open and closed questions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 51.0%                                                                                                                                                                                                                    | 100.0%                                       |
| Recommended reading             | <p>Basic literature</p> <p>J. Naumczyk, Environmental Chemistry, Wydawnictwo Naukowe PWN, 2017.</p> <p>G.W. vanLoon, S.J. Duffy, Environmental Chemistry, Wydawnictwo Naukowe PWN, 2008.</p>                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                          |                                              |

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|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>B. Główniak, E. Kempa, T. Winnicki: Podstawy ochrony środowiska, PWN, Warszawa, 1985.</p> <p>S.F. Zakrzewski, Podstawy toksykologii środowiska, Wydawnictwo naukowe PWN</p> <p>B. Dobrzański, S. Zawadzki; Gleboznawstwo, Państwowe Wydawnictwo Rolnicze i Leśne</p> <p>U. Pokojńska "Przewodnik metodyczny do analizy wód" Wydawnictwo UMK w Toruniu, Toruń 1999</p> <p>W. Szczepaniak "Metody instrumentalne w analizie chemicznej" PWN 2005</p> <p>B. Gomołka, E. Gomołka., "Ćwiczenia laboratoryjne z chemii wody" Wydawnictwo Politechniki Wrocławskiej, Wrocław 1992</p> <p>I. Hermanowicz, K. Dojlido, "Fizyczno-chemiczne badanie wody i ścieków", Wyd. Arkady, Warszawa 1999</p> <p>W. Łoginow, W. Cwojdzinski, J. Andrzejewski, Chemia rolna przewodnik do ćwiczeń dla studentów wydziału rolniczego i zootechnicznego, Akademia Techniczno-Rolnicza im. Jana i Jędrzeja Śniadeckich, Bydgoszcz 1996</p> <p>L. Wachowski, P. Kirszenstejn; Ćwiczenia z Podstaw Chemii Środowiska, Uniwersytet im. Adama Mickiewicza w Poznaniu, Poznań 1999</p> |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Adresy na platformie eNauczenie:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example issues/<br>example questions/<br>tasks being completed | <p>1. Soil consists of (multiple choice test): a) about 45% organic fraction, about 25% air, about 25% water and 5% mineral fraction b) About 45% mineral fraction, about 25% air, about 25% water and 5% organic matter c) Fulvic acids, humic acids and humins are counted among the humus compounds found in the soil organic fraction. d) The mineral fraction includes clay minerals such as kaolinite, montmorillonite, illite, among others.</p> <p>2) Name two types of smog and explain how they differ, under what conditions they occur. 3. Two chemicals are given: A with <math>\log P=7</math> and B with <math>\log P=0.5</math>. Please choose the correct answers (multiple choice test): a) A is a more lipophilic compound b) B is more lipophilic c) B is a more hydrophilic compound d) B chemical can be assumed to exist mainly in an aqueous environment with very poor sorption or bioaccumulation potential</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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