University of Gdańsk

Subject card

Subject name and code	Inorganic Chemistry, PG_00188274		
Field of study	Chemia nieorganiczna (Wykład)		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study 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	Polish polish
Semester of study	2	ECTS credits	3.0
Learning profile	academic	Assessment form	exam
Conducting unit	Laboratory of Physicochemistry of Coordination Complexes -> Department of General and Inorganic Chemistry -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Dariusz Wyrzykowski	
	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	10.0	35.0	75

Subject objectives

Consolidation of knowledge about the basic principles of inorganic chemistry, including periodicity, chemical bonds, and coordination chemistry.

Explanation of the role of inorganic chemistry in contemporary issues such as toxicology (heavy metals, poisons), and flame retardants.

Developing practical skills in conducting chemical experiments independently, with an emphasis on proper technique, safety, and accurate documentation.

Analyzing and interpreting experimental data from inorganic analyses and applying problem-solving skills to draw conclusions and solve problems related to the design and conduct of chemical experiments.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[AKRL3_W03] The graduate knows and understands the structure and chemical properties of compounds relevant in forensic examinations.	explains in detail the relationships between the structure of matter and its observed properties	[SW4] test/egzamin - ustny lub pisemny [SW1] wypowiedź ustna/rozmowa/ dyskusja
	[AKRL3_U01] The graduate is able to identify, analyse and solve complex research problems in chemistry and forensic science by selecting appropriate methods and information sources.	identifies, analyzes, and solves problems in the broad field of chemistry based on acquired knowledge	[SU1] wypowiedź ustna/rozmowa/ dyskusja [SU3] opracowanie tekstowe/ praca pisemna [SU5] realizacja zadania problemowego [SU8] obserwacja samodzielnej lub zespołowej pracy studenta

Subject contents	**A. Lecture** The lecture content focuses on the fundamental principles governing the structure of matter and chemical reactions, providing the theoretical foundation for the topics covered in the exercises. 1. Fundamentals of the Structure of Matter: • Origin and abundance of elements in nature. • The modern periodic table as a key to understanding element properties (the relationship between chemical structure and properties based on position, the periodic law). • Classification and characteristics of main-group and transition elements, as well as f-block elements (lanthanides and actinides), including the lanthanide contraction. 2. Chemical Bonds and Structure of Compounds: • Types of chemical bonds and their relation to the structure and physicochemical properties of compounds. • The influence of molecular polarity and the ability to form hydrogen bonds on the properties of substances. • Classification of inorganic compounds. 3. Reactivity and Selected Advanced Topics: • Redox properties of inorganic compounds depending on the element's oxidation state and environmental pH. • Cycles of selected elements in nature. • Fundamentals of coordination chemistry: concepts, properties, and the significance of complex compounds in biology and industry. • Introduction to organometallic chemistry (formation, properties, structure). • Practical applications of inorganic chemistry in industry and healthcare. **B. Auditorium Exercises (Tutorials)** The auditorium exercises are designed to deepen the theoretical knowledge from the lectures, with an emphasis on understanding advanced chemical models. • Advanced analysis of the periodic table of elements. • Chemical bonding theories: valence bond theory (including orbital hybridization and molecular geometry) and molecular orbital theory. • Characteristics of bonds in solids (ionic, covalent, metallic) and the resulting properties of materials (metals, semiconductors, insulators). • Structure, bonding, and properties of complex compounds. **C. Laboratory Exercises** The laboratory exercises aim to verify theoretical knowledge through practice, developing practical and

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<tr><td></td><td>analytical skills.

• The laboratory program involves carrying out a dozen or so experiments, the content of which is directly linked to the material discussed in the lectures.
• The student acquires practical skills in: safe laboratory work, techniques for the synthesis and analysis of inorganic compounds, and the interpretation of obtained experimental results.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>test/exam - oral or written</td><td>51.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>A. Bielański Podstawy chemii nieorganicznej, PWN 2002
J. D. Lee Zwięzła chemia nieorganiczna, PWN 1997
L. Jones, P. Atkins Chemia ogólna, PWN 2004
B. Literatura uzupełniająca
L. Pajdowski Chemia ogólna, PWN 1999</td></tr>
<tr><td>Supplementary literature</td><td>brak</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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Example issues/ example questions/ tasks being completed	**Task 1. (0.25 pts per equation)** Complete and balance the following chemical reaction equations: a) Na + NH b) KO + HO c) CaH + PbSO d) BaO + HSO **Task 2. (1 pt)** Boron does not occur in nature in its free state. Its primary source is borax (NaBO·10HO). Outline the process for obtaining elemental boron from borax, including all necessary reaction equations. **Task 3. (1 pt)** Which of the following compounds is paramagnetic: BaO or KO? Justify your answer by referring to the electronic structure of peroxide and superoxide ions. **Task 4. (1 pt)** Describe the industrial method for producing nitric(V) acid (nitric acid). The description should include the raw materials and key chemical reactions. **Task 5. (1 pt)** Discuss the redox properties of hydrogen peroxide by writing one reaction equation for each of the following cases, illustrating its role as: a) an oxidizing agent in an acidic environment, b) a reducing agent in an acidic environment, c) an oxidizing agent in a basic environment, d) a reducing agent in a basic environment. **Task 6. (1 pt)**

Although carbon is only the 14th most abundant element in the Earth's crust, the number of its compounds far exceeds the number of compounds of all other elements. Explain this phenomenon by referring to the unique properties of the carbon atom.

Task 7. (1 pt)

Using semi-structural (group) formulas, write the reaction equations leading to the formation of hexamethyldisiloxane from dichlorodimethylsilane, via an intermediate step involving trimethylchlorosilane.

Task 8. (1 pt)

Metallic silver is obtained through a cyanidation process, which involves leaching the ore with a potassium cyanide solution in the presence of oxygen, followed by the reduction of the resulting complex with zinc. Based on this description:

a) write the equations for the dissolution of silver and its recovery,

b) give the systematic names for all products containing metal ions.

Task 9. (1 pt)

A sodium hydroxide solution was added to an aqueous solution of mercury(II) nitrate. The resulting precipitate was isolated and divided into three parts. Two parts were treated with concentrated hydrochloric acid and concentrated sodium hydroxide, respectively.

Record the observations and write the reaction equations for the processes occurring in each of the described test tubes.

Task 10. (1 pt)

For the following sequence of chromium transformations:

Cr CrCl CrCl KCrO KCrO

a) write the ionic reaction equations (in short form),

b) state the color change of the solution accompanying each transformation.

Task 11. (1 pt)

Noble gases (except for He and Rn) are obtained by the fractional distillation of liquefied air, after the prior removal of oxygen and nitrogen. Propose and describe methods for removing oxygen and nitrogen from air before its liquefaction, writing the appropriate reaction equations.

Work placement	Not applicable

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