COURSE DESCRIPTION CARD - SYLLABUS

Course name

Chemia ogólna i niorganiczna (General and inorganic chemistry)

Course

Field of study

Technologia chemiczna (Chemical Technology)

Year/Semester

I/2

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

20

Laboratory classes

40

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

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Faculty of Chemical Technology

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Responsible for the course/lecturer:

Prerequisites

Knowledge:

Student has knowledge resulting from passing the course of General and Inorganic Chemistry in the first semester, in particular:

W1) Has extended knowledge regarding the structure of matter; identifies the components of matter and characterizes the interactions between them; knows the structure of atoms and the genesis of their creation; defines and explains the laws governing the interaction of matter components at both the nuclear and atomic levels

W2) Indicates the properties of elements resulting from the electronic configuration of their atoms and their position in the periodic table and, in particular, knows and explains the relationship between the electronic configuration of atoms and the reactivity of elements

W3) Knows the basic laws of thermodynamics and chemical kinetics as well as thermodynamic functions that allow to uniquely describe and characterize the energy state of the reaction system

Skills:

Student has the skills resulting from passing the course of General and Inorganic Chemistry in the first semester, in particular:

1. Student analyzes and interprets the content of computational tasks and performs chemical calculations (mainly in the field of concentration conversion, stoichiometry and basics of thermodynamics of chemical reactions)

2. Uses the periodic table of elements and is able to use it as a basic source of information about the physicochemical properties of elements and their compounds

3. Uses the current nomenclature of inorganic compounds and is especially able to combine the correct name of the compound with its correct summary (stoichiometric) formula, which can correctly write, and on this basis prepare its structural formula

4. Writes and correctly balances chemical reactions and is able to predict the direction of chemical reactions of any type; can quantify the steady state of the reaction (he can calculate the equilibrium constant of a chemical reaction)

Social competences:

Student has the social competences resulting from passing the course of General and Inorganic Chemistry in the first semester, in particular:

K1) Is aware of the continuous, rapid increase of knowledge in the field of inorganic chemistry, and on this basis - the level of his knowledge in this field, which causes him a determination and an active attitude in further study and assimilation of new knowledge on his own initiative

K2) Is aware that knowledge regarding inorganic chemistry is widely used in industry and the economy; understands in this connection and reckons with the necessity of practical use of acquired knowledge and skills in the future; is aware of the responsibility associated with this

Course objective

Overview of complexation reactions and oxidation and reduction reactions. Systematization of theoretical knowledge in the field of chemistry and the effects associated with the characteristic

reactions of cations and anions. Understanding the chemistry of major inorganic processes of technological importance. Knowing and understanding of global environmental phenomena. Enhancing knowledge regarding general and inorganic chemistry and expanding it with knowledge and practical skills related to work in a chemical laboratory. Introduction of the principles of safe work in the laboratory. Introduction of the organization of laboratory work and the basic techniques used in laboratory work. Teaching the correct interpretation of test results

Course-related learning outcomes

Knowledge

1. Has solid theoretical knowledge in the field of inorganic and general chemistry and, in particular, describes the structure of matter at the nuclear, atomic and molecular level; identifies the properties of elements and their compounds, explaining them in connection with the place of the element in the periodic table (K_W03, K_W08)

2. Knows the principles of health and safety at work in a chemical laboratory and, in particular, the principle of maintaining order in the workplace; knows the basic principles of first aid in the event of accidents and incidents (K_W018)

3. Lists and characterizes the basic techniques of laboratory work; knows how to plan and carry out a simple chemical experiment and how to analyze, develop and describe its results (K_W15)

4. Lists reactions involving inorganic compounds of great practical industrial importance. Describes, explains and characterizes their chemistry (course and associated effects) (K_W08, K_W09)

5. Lists and describes the most important harmful effects of some elements and inorganic compounds on the environment, and identifies the most important sources from which they are emitted to the environment (K_W07, K_W08)

Skills

1. Has well-established skills in the field of chemical calculations, using the periodic table of elements, notation of summary and structural formulas of chemical compounds as well as writing and balancing of any type of chemical reactions involving inorganic compounds (K_U01, K_U18)

2. Is able to analyze and solve typical chemical problems based on knowledge from various sources, including knowledge sought independently; knows how to compare knowledge from different sources (K_U01, K_U16)

3. Can organize his own work in a chemical laboratory; correctly applies laboratory work techniques; correctly uses laboratory equipment and correctly interprets the results obtained (K_U01, K_U07, K_U20)

4. Practically implements the principles of safe work in a chemical laboratory (K_U10, K_U28)

Social competences

1. Perceives the relationship between own safety as well as the safety of others working in a chemical

laboratory and the compliance with the regulations which apply in a chemical laboratory; develops a habit of maintaining order in the workplace (K_K03)

2. Is aware of the threat to the natural environment from some commonly used, inorganic chemical compounds; understands the need for action to minimize these harmful effects (K_K02, K_K07)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: final exam, consisting of 15-20 questions with the different number of points and varying degrees of difficulty - assessment threshold: 50% of the points. Based on the number of points obtained, the final grade is issued, according to the rating scale in force at Poznan University of Technology

Laboratory: the teacher regularly controls the theoretical preparation of students to perform planned exercises. The check is carried out by polling and / or in the form of written tests. The teacher observes and assesses the behavior of students in the laboratory, including the ability to organize laboratory work and their manual skills during the performance of the exercises planned. Written reports on performed exercises are subject to evaluation. The final grade is the result of the three components listed above

Programme content

Lecture (part 2 - continuation of the course from the first semester):

1 (7). Qualitative analysis. Division of anions and cations into analytical groups - group reagents. Characteristic reactions of selected cations and anions

2 (8). Complex compounds - structure and types. Equilibria in complex solutions - gradual formation of complexes. Complex durability and impermanence. Influence of pH on complexation reactions. Sediment solubility and complex formation. The use of complexes in analytics

3 (9). Oxidation and reduction (redox) reactions. Basic concepts. Half-reaction, redox reaction equilibrium constant, Nernst equation, normal potential, balancing redox reactions. Influence of pH on redox reactions. Redox imaging - potential-pH graphs (Pourbaix)). Determining the direction of reaction based on Pourbaix charts. Thermodynamic water stability. Strong oxidizers and reducing agents in aqueous solutions. Discussion regarding the chemical properties of basic elements based on the potential-pH graph. Mechanisms of iron corrosion and protection technologies

4 (10). Chemical properties of elements and their compounds. Characteristics of the "s" (lithium, beryllium), "p" (borohydrides, hydrocarbons, nitrites, oxides, halogen and helium), d- and f-electron block elements. Non-metals and their relationships. Hydrogen. Oxygen. Chlorine and halogens. Sulfur. Nitrogen. Phosphorus. Silicates. Aluminum silicates. Metals. Oxides, hydroxides and sulphides of metals. Review of metals using potential-pH charts. Obtaining the most important metals. Organometallic compounds. Preparation and applications of the most important inorganic compounds

5 (11). Inorganic compounds and the environment. Emission of pollutants into the atmosphere. Acid rain. The greenhouse effect. Ozone - the ozone hole. Water and soil pollution - heavy metals in the environment

Laboratory:

1. pH scale

2. Acid-base reactions

3. Reaction of quaoues solutions of salts

4. Buffer solutions

5. Ion separation by paper chromatography

6. Ion separation by ion exchange chromatography

7. Complexing reactions I (gradual complex formation, buffer solution of the complex compound)

8. Complexing reactions II (properties of complex compounds: complexes and acidity, stability of complex compounds)

9. Oxidation and reduction reactions I (reduction with metals, hydrogen ion as an oxidant, power of oxidants and reducers, the effect of temperature on the redox reaction)

10. Oxidation and reduction reactions II (effect of pH on redox reactions, disproportionation reactions)

11. Separation by precipitation

12. Separation by extraction

13. Verification of accuracy of laboratory pipettes

Teaching methods

Lecture. The lecture is conducted with the use of multimedia presentations with relevant examples; as a supplement, additional examples are presented on the board with appropriate explanations

Laboratory. Classes are practical, they consist in the students themselves doing exercises included in the course plan. Exercises are performed in accordance with the attached instructions. The teacher personally shows and explains how to perform the activities and operations that students meet for the first time. The teacher constantly controls the student's behavior in the laboratory and the way of performing his work themselves. He immediately notices and corrects irregularities

Bibliography

Basic

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3. A. Bielański, Podstawy chemii nieorganicznej, t.1-3, PWN, Warszawa 2012

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Additional

1. A. Ciszewski, M. Baraniak, Aktywność chemiczna i elektrochemiczna pierwiastków w środowisku wody, Wydawnictwo PP, Poznań 2006

3. B. Chmielewska-Bojarska, Chemia analityczna. Analiza jakościowa kationów i anionów, Wydawnictwo Uniwersytetu Łódzkiego 2012

3. W. N. Aleksiejew, Analiza jakościowa, PWN, Warszawa 1968

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PWN, Warszawa 1995

5. L. Kolditz, Chemia nieorganiczna, PWN, Warszawa 1994

6. M.J. Sienko, R.A. Plane, Chemia. Podstawy i zastosowania, WNT, Warszawa 2002

7. W. Ufnalski, Podstawy obliczeń chemicznych z programami komputerowymi, WNT, W-wa 1999

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Breakdown of average student's workload

	Hours	ECTS
Total workload	140	5,0
Classes requiring direct contact with the teacher	65	2,3
Student's own work (literature studies - preparation for lectures, preparation for laboratory classes, preparation of laboratory reports, preparing for the partial tests (laboratory) and for the final exam) [1]	75	2,7

[1] delete or add other activities as appropriate