COURSE DESCRIPTION CARD - SYLLABUS

Course name

Chemia fizyczna

Course

Field of study

Technologia Chemiczna (Chemical Technology)

Year/Semester

III/6

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

30

Other (e.g. online)

0

Tutorials

20

Projects/seminars

0

Number of credit points

7

Lecturers

Responsible for the course/lecturer:

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Wydział Technologii Chemicznej

ul. M. Skłodowskiej-Curie 5, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Students:

have knowledge in general chemistry (writing chemical reactions, converting concentrations, knowledge of laboratory glassware and basic laboratory equipment).

have knowledge in mathematics and physics enabling the introduction of problems in physical chemistry (basic laws of physics, differential calculus).

are able to prepare solutions of specific concentrations.

are aware of further development of their competences.

Course objective

To familiarise students with basic problems in physical chemistry at the academic level in the field of: kinetics (simple and complex reactions, catalysis), electrochemistry (ionics , electrodes) and surface phenomena.

Course-related learning outcomes

Knowledge

K_W08. The graduate has a systematzed, general theoretical knowledge of basic annd inorganic chemistry, organic physical and analytial chemistry.

K_W10. knows the basics of thermodynamics, kinetics, surface phenomena and catalysis.

Skills

K_U01. The graduate can obtain necessary information from literature, databases and other sources related to chemical sciences, interpret them properly, draw conclusions, formulate and justify opinions.

K_U18. distinguishes between types of chemical reactions and to select them for specific chemical processes.

K_U22. determines physical and chemical determine physical, chemical, mechanical and thermal properties of chemical compounds.

K_U23. applies the principles of thermodynamics in the implementation of chemical processes.

Social competences

K_K01. understands the need for further training and developing their professional, personal and social competences.

K_K04. Students will be able to properly prioritise the task.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: exame

Exercises: written test, passing the test above 75%

Laboratory: The course passing is based on points received for the individual exercise description

Programme content

LECTURE

Kinetics - Simple reactions. Description of the rate of chemical reactions, mechanism and the impact of various factors on the rate of reaction. Molecularity. Reaction order. Kinetic equations. Half-life. The dependence of the reaction rate on concentration. Dependence of the reaction rate on temperature - activation energy. Active collision theory - Arrhenius equation, Active complex theory - Eyring equation. Kinetics - complex reactions. Reversible reactions. Parallel reactions. Subsequent reactions -

intermediate. Chain reactions. Steady state approximation. Enzymatic Reactions. Explosive reactions. Oscillatory reactions. Catalysis. Catalyst definition. Mechanism of catalyst operation. Types of catalysis. Heterogeneous catalysis. Homogeneous catalysis.

Electrochemistry - Ionics, Electrolyte dissolution, ionic and non-ionic substances Solvation, Electrolytic dissociation Colligative properties of electrolytes - cryometry, isotonic coefficient, Partial molar quantities, excess functions Chemical potential. Activity, activity coefficient. Theory of strong electrolytes. Electrical conductivity of electrolyte solutions. Ion migration. Electrolytic and molar conductivity. Dependence on concentration, temperature, the pressure of electrolyte type. Transfer number. Mobility. Application of conductivity measurements. The conductivity of molten salts.

Electrochemistry - Electrodes. Phase potential. Phase internal potential - Galvanni potential, phase external potential - Volta potential, surface potential. Double electrical layer. Equilibrium condition - electrochemical potential. Equilibrium chemical reaction - Nernst equation. Types of electrodes - electrochemical series. Galvanic cells - phenomenological description. Forced chemical reaction, electrolysis.

Surface phenomena. Vapor pressure over a curved surface. Surface tension - definition, measurement.

Adsorption - a description of the phenomenon. Physical and chemical adsorption. Isotherm.

EXERCISES AND LABORATORY

Mathematical description of the rate of chemical reactions. Determination of rates, constant rates of simple chemical reactions. Calculation of the order of chemical reactions based on experimental data. Methods for determining orders of chemical reactions. Complex reaction kinetics. Dependence of the reaction rate constant on temperature - calculation of the reaction activation energy from the Arrhenius equation. Eyring equation - determining the enthalpy and entropy of activation of the active complex. Calculations regarding the electrical properties of electrolyte solutions: transfer numbers, conductivity, ion mobility. Electrolysis, Faraday's laws, electrochemical calculations. Electrode potentials, determination of standard half-cell potentials - Nernst's equation. Construction of galvanic cells, calculation of electromotive forces. The equation of the process is the source of electrical work. Determination of the standard SEM. Calculation of standard thermodynamic functions of a chemical reaction based on SEM measurement of cells.

Teaching methods

Lecture - presentation

Exercises with discussion. Deductive method. The exercises involve solving partial tasks and solving detailed problems.

Laboratory - practical method - laboratory exercises. Planning, execution and analysis of the results of physicochemical experiment..

Bibliography

Basic

Lecture - presentation

Exercises with discussion. Deductive method. The exercises involve solving partial tasks and solving detailed problems.

Laboratory - practical method - laboratory exercises. Planning, execution and analysis of the results of physicochemical experiment.

Additional

1. P. Atkins, Podstawy Chemii Fizycznej, PWN, Warszawa 1999

2. L. Sobczyk, A. Kisza, Chemia fizyczna dla przyrodników PWN Warszawa 1977

3. H. Buchnowski, W. Ufnalski Wykłady z chemii fizycznej WNT Warszawa 1998

4. P.W. Atkins, C.A Trapp, M.P.Cady, C.Giunta Chemia fizyczna. Zbiór zadań z rozwiązaniami.

5. J. Demichowicz-Pigoniowa Obliczenia fizykochemiczne, Wydawnictwo Politechniki Wrocławskiej Wrocław 1997.

6. W.Ufnalski. Obliczenia fizykochemiczne. Wydawnictwo Politechniki Warszawskiej 1995

Breakdown of average student's workload

	Hours	ECTS
Total workload	175	7,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	100	4,0

[1] delete or add other activities as appropriate