DESCRIPTION OF THE COURSE OF STUDY

Course code	**0532-2CHEM-C05-CF**	
Name of the course in	Polish	**Chemia fizyczna**
	English	**Physical Chemistry**

1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

1.1. Field of study	Chemistry
1.2. Mode of study	Full-time studies
1.3. Level of study	First-cycle studies
1.4. Profile of study*	General academic
1.5. Person/s preparing the course description	prof. dr hab. Piotr Słomkiewicz, dr Katarzyna Jedynak
1.6. Contact	piotr.słomkiewicz@ujk.edu.pl katarzyna.jedynak@ujk.edu.pl

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	English
2.2. Prerequisites*	mathematics, physics, basics of chemistry

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		Lectures, laboratory exerices, seminar
3.2. Place of classes		Classes in the teaching room of the UJK
3.3. Form of assessment		Lecture - exam, laboratory exercises and seminar - credit with grade
3.4. Teaching methods		Lecture, use of audiovisual resources, discussion, demonstration Seminar, solving tasks and problems Laboratories, independent experiments
3.5. Bibliography	**Required reading**	1. Peter Atkins, Julio De Paul, James Keeler, Physical Chemistry, Oxford University Press, 2022 2. Finn Miller, Physical Chemistry, Willford Press 2017 3. Langdon Jamie, Physical Chemistry and Its Applications, Willford Press 2017
	Further reading	Hofmann Andreas, Physical Chemistry Essentials, Springer International Publishing AG 2018

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives ***(including form of classes)***

Lecture:

C1. Teaching the student basic issues of physical chemistry

C2. Understanding the relationship between physicochemical laws and specific problems

Seminar:

C3. Ability to apply basic calculation methods to typical physical chemistry problems

C4. Acquiring the ability to independently solve physicochemical tasks and problems

Laboratory exercises:

C5. The student can perform laboratory tasks independently and correctly prepare measurement results

C6. Principles of operation and operation of basic physicochemical equipment

C7. Ability to analyze the results obtained during measurements

4.2. Detailed syllabus ***(including form of classes)***

Lecture:

1. States of matter and properties of gases.
2. Description of the states of matter. Equation of state. Gas mixtures and partial pressures. Gas kinetic theory. Real gases.
3. Thermodynamics; first rule.
4. The law of conservation of energy. Internal energy. Enthalpy.
5. Thermodynamics; second rule.
6. Entropy. Free enthalpy. Reactions at equilibrium.
7. Phase equilibria.
8. Phase diagrams of pure substances. Properties of non-electrolyte solutions. Phase diagrams of two-component systems.
9. Chemical balance.

10. Interpretation of equilibrium states. Acids and bases. Solubility balance.
11. Electrochemistry.
12. Galvanic cells. Applications reduction potential.
13. Chemical kinetics.
14. Empirical chemical kinetics. Justification of kinetic equations. Explosive reactions.
15. Chemical bonding.
16. Theory of valence bonds. Molecular orbitals. Band theory of solids.

Seminar:
Calculation methods used in typical tasks in the field of physical chemistry: calculation of thermodynamic functions and thermal effects of transformations, including chemical transformations (Hess's law and Kirchoff's law), thermodynamic description of the state of chemical equilibrium and phase equilibrium, parameters affecting the state of equilibrium, phenomena occurring at the phase boundary , determining the rate of a chemical reaction, the order of the reaction, the influence of temperature on the rate of a chemical reaction, description of electrode phenomena, calculation of EMF.

Laboratory exercises:
During experiments, the student performs laboratory exercises in the following branches of physical chemistry: thermodynamics (e.g. determination of partial molar quantities), thermochemistry (calorimetric measurements), transport processes (e.g. liquid viscosity), phase equilibria, equilibria in electrolyte solutions, interfacial phenomena (e.g. surface tension), electrochemistry (e.g. electrolysis), kinetics and catalysis. The student learns the basics of operation and operation of such basic devices as: calorimeter, conductivity meter, pH meter, electrolyzer, viscometer, tensionmeter, specol .

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	Characterizes and describes states of matter. Defines state functions. Correctly interprets equilibrium constants. Justifies kinetic equations.	CHEM1A_W05
W02	Understands the basic relationships in physical chemistry and the scope of their application. Knows the basic computational methods used in physical chemistry.	CHEM1A_W05
within the scope of **ABILITIES:**		
U01	Describes, interprets and classifies laws and relationships in the field of physical chemistry.	CHEM1A_U01
U02	Is able to solve specific tasks from individual branches of physical chemistry. Exercises caution in laboratory work.	CHEM1A_U01
U03	Student can analyze the obtained results in terms of their probability and theoretical data found in the literature	CHEM1A_U11
U04	Is able to learn independently, present issues in physical chemistry clearly and prepare written works on laboratory exercises performed	CHEM1A_U11
U05	Able to work in a group, develops self-control through punctuality and responsibility	CHEM1A_U14
within the scope of **SOCIAL COMPETENCE:**		
K01	Is aware of the critical assessment of his knowledge	CHEM1A_K01

4.4. Methods to verify the achievement of the learning outcomes

Teaching outcomes *(code)*	Method of verification (+/-)											
	Exam oral/written*			Test*			Project*			Group work*		
	Form of classes			*Form of classes*			*Form of classes*			*Form of classes*		
	W	*C*	*...*	*W*	*K*	*L.*	*W*	*K*	*L*	*W*	*K*	*L*
W01	+				+	+						
W02	+				+	+						
U01												+
U02					+							+
U03					+	+			+			+
U04					+	+			+			+
U05					+				+			
K01	+											

delete as appropriate

4.5. Criteria of assessment of the intended learning outcomes		
Form of classes	**Grade**	**Criterion of assessment**
lecture (L) (including e-learning)	**3**	Exam - test, 51-60% correct answers
	3,5	Exam - test, 61-70% correct answers
	4	Exam - test, 71-80%correct answers
	4,5	Exam - test, 81-90%correct answers
	5	Exam - test, 91-100% correct answers
Seminar including e-learning)	**3**	Credit with grade - test, 51-60% correct answers
	3,5	Credit with grade - test, 61-70% correct answers
	4	Credit with grade - test, 71-80% correct answers
	4,5	Credit with grade - test ,81-90% correct answers
	5	Credit with grade - test, 91-100% correct answers
Laboratory exercises (including e-learning)	**3**	Credit with grade - test, 51-60% correct answers
	3,5	Credit with grade - test, 61-70% correct answers
	4	Credit with grade - test, 71-80% correct answers
	4,5	Credit with grade - test, 81-90% correct answers
	5	Credit with grade - test, 91-100% correct answers

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	Student's workload	
	Full-time studies	**Extramural studies**
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	***165***	***95***
Participation in lectures	60	30
Participation in seminars	45	30
Participation in laboratories	60	35
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	***135***	***205***
Preparation for the seminars, laboratories	50	60
Preparation for the lecture and exam	40	60
Preparation of reports	45	85
TOTAL NUMBER OF HOURS	***300***	***300***
ECTS credits for the course of study	**12**	**12**

Accepted for execution *(date and legible signatures of the teachers running the course in the given academic year)*

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