



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Thermodynamics - Energetics of Chemical Reactions

### Course

Field of study

Circular System Technologies

Area of study (specialization)

-

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

polish

Requirements

elective

### Number of hours

Lecture

0

Laboratory classes

0

Other (e.g. online)

0

Tutorials

15

Projects/seminars

0

### Number of credit points

1

### Lecturers

Responsible for the course/lecturer:

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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).

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

Students are able to prepare solutions of specific concentrations.

Students are aware of further development of their competence.

### Course objective

The aim of the tutorials is to familiarize the student with the calculations of thermodynamic parameters,



determination of changes in thermodynamic functions, physical changes and chemical processes. Determining the energy effects of chemical reactions on the basis of table values. Ability to predict the direction of chemical reactions and to determine the influence of, for example, temperature or pressure on the chemical equilibrium constant.

### Course-related learning outcomes

#### Knowledge

The student has knowledge of physics and chemistry allowing to understand the phenomena and changes occurring in technological and environmental processes (K\_W02).

The student has an ordered, theoretically founded knowledge covering key problems in the field of technical thermodynamics (K\_W17).

#### Skills

The student is able to obtain information from literature, databases and other sources related to circular system technologies, also in a foreign language, to integrate them, interpret and draw conclusions and formulate opinions (K\_U01).

The student has the ability to self-study, is able to use source information in Polish and a foreign language in accordance with the principles of ethics, reads with understanding, conducts analyzes, syntheses, summaries, critical assessments and correct conclusions (K\_U04).

The student correctly uses in the discussion and correctly uses the nomenclature and terminology in the field of circular system technology, chemistry, technology and chemical engineering, environmental protection and related disciplines, also in a foreign language (K\_U05).

#### Social competences

The student independently determines and implements the action plan entrusted to him, defining the priorities for its implementation, critically assesses the level of advancement in the implementation of the assigned task (K\_K03).

Objectively assesses the level of their knowledge and skills, understands the importance of improving professional and personal competences adequately to the changing social conditions and the progress of science (K\_K05).

Participates in discussions and is able to conduct discussions, is open to different opinions and ready to assertively express feelings and critical comments (K\_K08).

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Calculation exercises:

assessment on the basis of points obtained for activity during classes, passing tests and tests. Passing threshold: 60% of points.

### Programme content



Calculations of thermodynamic parameters and physicochemical functions in the field of thermodynamics: Principles of thermodynamics. Heat balance of chemical reactions. Calculation of thermal effects on the basis of table values. Heat capacity  $C_v$  and  $C_p$  and their dependence on temperature. Calculating the influence of temperature on the thermal effects of chemical processes. Standardization of thermal effects of chemical reactions. Determining the direction of a chemical change. Entropy as a function of state that determines the direction. Thermodynamic potentials - calculation of the equilibrium constant of chemical reactions. Determining the influence of temperature on the chemical equilibrium constant.

### Teaching methods

Calculation exercises with discussion. Deductive method. Exercises consist of solving partial tasks and solving detailed problems.

### Bibliography

Basic

1. P. Atkins, Chemia Fizyczna, PWN Warszawa 2019.
2. P. Atkins, C.A. Trapp, M.P. Cady, C. Giunta, Chemia fizyczna. Zbiór zadań z rozwiązaniami.
3. J. Demichowicz-Pigoniowa, Obliczenia fizykochemiczne, Wydawnictwo Politechniki Wrocławskiej Wrocław 1997.
4. W. Ufnalski, Obliczenia fizykochemiczne, Wydawnictwo Politechniki Warszawskiej 1995.

Additional

1. P. Atkins, Podstawy Chemii Fizycznej, PWN Warszawa 1999.
2. L. Sobczyk, A. Kiszka, Chemia fizyczna dla przyrodników, PWN Warszawa 1977.
3. J. Minczewski, Chemia analityczna, PWN Warszawa 2005.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,0
Classes requiring direct contact with the teacher	16	0,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests) <sup>1</sup>	9	0,5

<sup>1</sup> delete or add other activities as appropriate