



Subject card

Subject name and code	Organic Chemistry, PG_00059032						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2023/2024		
Education level	first-cycle 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	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Organic Chemistry -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Grzegorz Cholewiński					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	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	45		5.0		75.0	125
Subject objectives	Getting familiar with the structure and reactivity of the most important groups of organic compounds as factors determining the physical and chemical properties of materials						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_U05	Understanding the influence of the elements of a chemical compound's structure on its reactivity and physicochemical properties. A rational attempt to predict the properties and reactivity of a new compound based on its structure.	[SU2] Assessment of ability to analyse information
	K6_K01	Due to the interdisciplinary nature of materials engineering, the diversity of factors determining the properties of materials, including organic compounds, the student understands the need to improve professional and personal competences; is aware of own limitations and knows when to turn to experts, is able to appropriately define priorities for the implementation of tasks defined by himself/herself or others.	[SK2] Assessment of progress of work
	K6_U01	Understands the importance and knows the methods for measuring parameters that identify a chemical substance (phase transition temperatures, refractive index, optical rotation).	[SU2] Assessment of ability to analyse information
	K6_W02	Knows the structure of basic groups of chemical compounds and its influence on the reactivity and physicochemical properties of substances that are components of materials.	[SW1] Assessment of factual knowledge

Subject contents	<p>1. Structure of organic compounds. Chemical bonds: covalent, polar, ionic. Lewis structures, formal charge, resonance. Hybridized orbitals <math>sp^3</math>, <math>sp^2</math>, <math>sp</math> in the structures of organic molecules. Acids and bases in organic chemistry. Polarity of molecules. Intermolecular interactions.</p> <p>2. Alkanes and cycloalkanes: homologous series of organic compounds. IUPAC nomenclature. Conformation of molecules. Constitutional and geometric isomerism. Free radical substitution.</p> <p>3. Halogenated derivatives of aliphatic hydrocarbons: Optical isomerism, chiral molecules, enantiomers. Rules of priority in determining configuration (R, S). Nucleophilic substitution and elimination reactions.</p> <p>4. Unsaturated hydrocarbons: alkenes and alkynes - structure, preparation, properties. Addition reactions to double and triple bonds. The concept of tautomerism. Properties of conjugated unsaturated systems: dienes and polyenes. Diels-Alder reaction.</p> <p>5. Aromatic hydrocarbons: benzene - structure and basic properties. Electrophilic substitution reactions - reaction mechanism, directing influence of substituents. Aromatic hydrocarbons with fused rings.</p> <p>6. Alcohols and phenols: structure, properties, basic reactions of alcohols and phenols. Synthesis of alcohols based on organomagnesium compounds.</p> <p>7. Ethers, epoxides: structure, properties and methods of synthesis of ethers. Acidic cleavage of ethers. Epoxide ring opening reactions. Crown ethers.</p> <p>8. Aldehydes and ketones: nomenclature, synthesis and chemical Properties. Nucleophilic addition to the carbonyl Group. Oxidation and reduction, Cannizzaro reaction, enolate ions, aldol condensation.</p> <p>9. Carboxylic acids and their derivatives: structure and nomenclature of carboxylic acids. Carboxylic acid derivatives: esters, acid halides, anhydrides, nitriles and amides. Nucleophilic substitution in the acyl group.</p> <p>10. Amines: nomenclature, structure, basicity and preparation of amines. Basic reactions, diazonium salts, azo dyes.</p>														
Prerequisites and co-requisites															
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="453 1225 794 1261">Subject passing criteria</th> <th data-bbox="794 1225 1139 1261">Passing threshold</th> <th data-bbox="1139 1225 1482 1261">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 1261 794 1292">exam</td> <td data-bbox="794 1261 1139 1292">60.0%</td> <td data-bbox="1139 1261 1482 1292">50.0%</td> </tr> <tr> <td data-bbox="453 1292 794 1323">tests</td> <td data-bbox="794 1292 1139 1323">50.0%</td> <td data-bbox="1139 1292 1482 1323">25.0%</td> </tr> <tr> <td data-bbox="453 1323 794 1361">tests</td> <td data-bbox="794 1323 1139 1361">50.0%</td> <td data-bbox="1139 1323 1482 1361">25.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	exam	60.0%	50.0%	tests	50.0%	25.0%	tests	50.0%	25.0%
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<p>Example issues/ example questions/ tasks being completed</p>	<p>1. Based on the occurring chemical reactions, explain the significant amounts of heat released during the complete combustion of ethyne (acetylene).</p> <p>2. Pentaerythritol (formally: 2,2-bis(hydroxymethyl)-propane-1,3-diol) is a tetrahydric alcohol that is widely used as an intermediate in chemistry and technology, e.g. a substrate for the synthesis of stabilizers for polymer materials. It is formed in the reaction of formaldehyde with an excess of ethanal under basic conditions. Present occurring chemical reactions.</p> <p>3. Explain the effect of molecular structure on the boiling point: ethanal 20.2 °C, ethanol 78.4 °C, acetic acid 117.9 °C.</p>
<p>Work placement</p>	<p>Not applicable</p>

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