



## Subject card

Subject name and code	Chemistry III, PG_00039786						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	October 2020		Academic year of realisation of subject		2021/2022		
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		blended-learning		
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		dr hab. inż. Grzegorz Cholewiński				
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: 30.0						
	Adresy na platformie eNauczanie: 2021-22/Inżynieria Materiałowa/Chemia III - Moodle ID: 18372 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=18372">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=18372</a>						
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		15.0		65.0	125
Subject objectives	The main goal is to acquaint the student with the basics of organic chemistry including: structure, chemical and physical properties of organic compounds.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U01		A student is able to use properly selected analytical, simulation and experimental methods and devices enabling measurement of basic quantities characterizing materials and technological processes		[SU3] Assessment of ability to use knowledge gained from the subject		
	K6_K01		A student understands the need to improve professional and personal competences; is aware of its own limitations and knows when to turn to experts, it can properly set priorities for the implementation of its or other tasks		[SK3] Assessment of ability to organize work [SK2] Assessment of progress of work		
	K6_U05		A student is able to learn independently		[SU3] Assessment of ability to use knowledge gained from the subject		
	K6_W02		A student has knowledge of physics and chemistry useful for formulating and solving simple tasks in the field of materials science		[SW1] Assessment of factual knowledge		

Subject contents	<p>1. <b>Structure of organic compounds:</b> Chemical bonds: covalent, polar covalent and ionic. Writing Lewis structures, formal charge, resonance. <math>sp^3</math>, <math>sp^2</math>, <math>sp</math> Hybridization in molecules of organic compounds. Acids and bases in organic chemistry. Molecular dipole moments. Intermolecular interactions.</p> <p>2. <b>Alkanes and cycloalkanes:</b> The homologous series of organic compounds. IUPAC nomenclature of alkanes and cycloalkanes. Conformation of molecules. Isomerism: constitutional isomers and stereoisomers. Halogenation of alkanes. Radical substitution reactions.</p> <p>3. <b>Alkyl Halides:</b> Enantiomers and chiral molecules. Nomenclature of enantiomers: the (<i>R,S</i>) system. Nucleophilic substitution and elimination reactions of alkyl halides.</p> <p>4. <b>Unsaturated Hydrocarbons:</b> Alkenes and alkynes – structure, properties and synthesis. Addition reactions of alkenes and alkynes. Keto-enol tautomerism. Conjugated unsaturated systems : alkadienes and polyunsaturated hydrocarbons. The Diels-Alder reaction.</p> <p>5. <b>Aromatic compounds:</b> benzene – structure and properties. Nomenclature of benzene derivatives. Representative electrophilic aromatic substitution reactions of benzene. Mechanistic principles of electrophilic aromatic substitution and substituent effects. Polycyclic aromatic hydrocarbons.</p> <p>6. <b>Alcohols and phenols:</b> Physical properties of alcohols and phenols. Synthesis of alcohols using Grignard Reagents.</p> <p>7. <b>Ethers, epoxides:</b> Structure, physical properties and preparation of ethers and epoxides. Acid-catalyzed cleavage of ethers. Nucleophilic ring opening of epoxides. Crown ethers.</p> <p>8. <b>Aldehydes and ketones:</b> Nomenclature and physical properties. Sources of aldehydes and ketones. Nucleophilic addition to the carbonyl group. Reactions of aldehydes and ketones: oxidation, reduction, the Cannizzaro reaction, enols and enolate ions, the aldol condensation.</p> <p>9. <b>Amines:</b> Nomenclature, physical properties and structure of amines. Basicity of amines – amine salts. Preparations and reactions of amines. Arenediazonium salts and azo dyes.</p> <p>10. <b>Carboxylic acids and their derivatives:</b> Structure and nomenclature of carboxylic acids. Structure and reactivity of carboxylic acid derivatives: acyl chlorides, esters, amides, nitriles and carboxylic acid anhydrides. Nucleophilic substitution at the acyl carbon.</p>		
Prerequisites and co-requisites	Knowledge of the structure of elements, especially carbon; the concept of acids, bases and salts; reaction types; geometry of molecules		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exam	60.0%	50.0%
	tests written during tutorials	50.0%	25.0%
	colloquia written during the lectures	50.0%	25.0%
Recommended reading	<p>Basic literature</p> <p>1. J. D. Caserio, M. C. Roberts CHEMIA ORGANICZNA, PWN Warszawa, 1969</p> <p>2. R. T. Morrison, R. N. Boyd CHEMIA ORGANICZNA, PWN Warszawa, 1997</p> <p>3. J. McMurry CHEMIA ORGANICZNA, PWN Warszawa, 2002</p> <p>4. T. W. G. Solomons ORGANIC CHEMISTRY - 6th ed, John Wiley &amp; Sons, Inc. New York, 1996</p>		

	Supplementary literature	1. J. March CHEMIA ORGANICZNA - Reakcje, mechanizmy, budowa, WNT Warszawa 1975  2. F. A. Carey ORGANIC CHEMISTRY - 4th ed, McGraw-Hill Higher Education, 2000
	eResources addresses	2021-22/Inżynieria Materiałowa/Chemia III - Moodle ID: 18372 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=18372">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=18372</a>
Example issues/ example questions/ tasks being completed	Show how: a) /Z/-1-Phenyl-1-propene, b) /E/-1-Phenyl-1-propene, c) 1-Phenyl-1-butyne can be prepared from phenylacetylene and any inorganic and organic reagents.	
Work placement	Not applicable	