University of Gdańsk

Subject card

Subject name and code	Acid-base properties of organic compounds and pharmaceutics, PG_00171096						
Field of study	Chemistry						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2027/2028			
Education level	Master's studies		Subject group	Optional subject group			
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	1.0			
Learning profile	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Beata Liberek					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		10.0	5.0	30	
Subject objectives	The aim of the course is to acquire the ability to predict: (1) acid-base properties of mono- and multifunctional organic compounds and pharmaceuticals in solutions with different pH values, (2) the effect of acid/base addition on the course of an organic reaction.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEMMU2_U03] Finds necessary information in specialist literature, databases and other sources, lists basic scientific journals in chemistry.	Assesses the possibility of an acid-base reaction and the behavior of a pharmaceutical in solution based on data obtained from the literature or database.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[CHEMMU2_U02] Critically assesses the results of conducted, performed observations and theoretical calculations and discusses errors.	Discusses the need to use acid or base catalysis for specific organic reactions; critically evaluates measurement results presented in the literature.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[CHEMMU2_U04] Applies acquired knowledge of chemistry and related scientific disciplines.	Sorts organic compounds according to acidity and basicity; explains the influence of a compound's structure on its acidity.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[CHEMMU2_W11] Demonstrates general knowledge about the current trends in the development of chemistry as a science and the latest discoveries in this field.	Defines the basic concepts of the Brønsted-Lowry, Lewis and Personn theories of acidity; associates the structure of a compound with its acid-base properties.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[CHEMMU2_W04] Applies the acquired knowledge to an in-depth description of the properties of chemical connections, methods of their synthesis and analysis.	Associates the sites of protonation and deprotonation of organic compounds, multifunctional compounds and pharmaceuticals; associates the direction of acid-base reactions.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[CHEMMU2_W05] Has extended knowledge in the field of the specialisation studied.	Associates the successive stages of deprotonation; interprets ionization profiles of compounds; explains the effect of solution pH on the form of a pharmaceutical.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[CHEMMU2_K04] Correctly identifies and resolves dilemmas related to the profession of a chemist.	Correctly identifies the problem of acidity and alkalinity of organic compounds and pharmaceuticals.	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written
[CHEMMU2_K03] Understands the need for systematic work on various projects of a long-term nature and knows how to set priorities for the implementation of undertaken tasks.	Understands the need for a comprehensive view of a problem; discusses different approaches to a problem; demonstrates creativity; understands the need for interoperability between different project elements.	[SK1] oral statement/conversation/ discussion
[CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.	Remains critical; appreciates the component parts of acquired knowledge; engages in discussions about acidity with other people.	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written

Subject contents

The influence of organic compounds acidity on the reaction course; Brønsted-Lowry theory; thermodynamic and kinetic acidity constants; Henderson-Hasselbalch equation; the neutralization half point; pK_a and pK_b of H_3O^+ and HO^- ions; acidity constant and state of the acid-base reaction equilibrium; influence of the compounds structure on its acid-base properties: electronegativity, size, hybridization, inductive effect, hyperconjugation, mesomeric effect, aromaticity, steric effects, conformation, hydrogen bond; organic compounds ordering in terms of their acidity; super acids; the Hammett acidity function; carbocations, super bases; Lewis theory; Pearsons theory; hard and soft acids and basis; influence of the hard and soft acid and bases on the reactivity of compounds; relativity of the acid-base concept; solvent leveling effects; amino acids, isoelectric point, titration curves; estimation of acid-base properties of pharmaceutics; influence of the pH on the form of pharmaceutic, drug distribution versus its acid-base properties.

Prerequisites and co-requisites

Knowledge of basic concepts in general chemistry relating to acidity; knowledge of groups of organic compounds, their structure and chemical properties; knowledge of the basics of kinetics and thermodynamics of chemical reactions.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
10-15 questions testing knowledge of the material covered during lectures and 1-2 problems to solve	51.0%	100.0%

Recommended reading

Basic literature

M. B. Smith, J. March *Marchs Advanced Organic Chemistry*

P. Y. Bruice *Organic Chemistry*

D. Cairns *Essentials of Pharmaceutical Chemistry*

	Supplementary literature	I. Wandzik Chemia leków i proleków
	eResources addresses	
Example issues/ example questions/ tasks being completed	In what form will phenylbutazone (pKa 4.5) occur in a solution at pH 7? Indicate the nitrogen atom in the structure of zopiclone that is most likely to be protonated. Write three consecutive acid-base equilibria for penicillamine, for which the acidity constants are: pK_{a1} 1.8, pK_{a2} 7.9, and pK_{a3} 10.5.	
Work placement	Not applicable	

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