



# Pomeranian Medical University in Szczecin

## SYLLABUS of the MODULE (Medical Chemistry) General Information

Module title: Medical Chemistry	
Module type	Obligatory
Faculty PMU	Faculty of Medicine and Dentistry
Major	Dentistry
Level of study	long-cycle (S2J)
Mode of study	full-time studies
Year of studies, semester	I/I
ECTS credits (incl. semester breakdown)	3
Type/s of training	seminars (17h)/practical (23)
Form of assessment*	<input checked="" type="checkbox"/> graded assessment: <ul style="list-style-type: none"> <li><input type="checkbox"/> descriptive</li> <li><input checked="" type="checkbox"/> test</li> <li><input type="checkbox"/> practical</li> <li><input type="checkbox"/> oral</li> </ul> <input type="checkbox"/> non-graded assessment <input type="checkbox"/> final examination <ul style="list-style-type: none"> <li><input type="checkbox"/> descriptive</li> <li><input type="checkbox"/> test</li> <li><input type="checkbox"/> practical</li> <li><input type="checkbox"/> oral</li> </ul>
Head of the Department/ Clinic, Unit	Prof. dr hab. Izabela Gutowska
Tutor responsible for the module	Dobrosława Stańkowska-Walczak, Ph.D. dobroslaw.walczak@pum.edu.pl 91 466 1644
Department's/ Clinic's/ Unit's website	Medical Chemistry Department <a href="https://www.pum.edu.pl/wydzialy/wydzial-lekarski/katedra-biochemii-i-chemii-medycznej/zaklad-chemii-medycznej">https://www.pum.edu.pl/wydzialy/wydzial-lekarski/katedra-biochemii-i-chemii-medycznej/zaklad-chemii-medycznej</a>
Language	English

\* replace ☐ into ☒ where applicable

## Detailed information

<p><b>Module objectives</b></p>		<p>The purpose of teaching medicinal chemistry is to prepare students to learn and understand the metabolic processes presented in the course of medical studies. Students will become familiar with basic issues of bioinorganic chemistry, bioorganic, physical and analytical. Student will learn approximate relationship between the structure and chemical properties and function of compounds found in living organisms. Teaching begins with a discussion of the chemical bonds stabilizing chemical structure. Then widely discussed are the properties of water and solutions, as the dominant component of the human body. Particular emphasis is placed on familiarizing students with the basics including calculation, fluid and electrolyte balance and acid-base balance. Students also learn about the chemical composition and some properties of saliva.</p> <p>Other issues of bioinorganic chemistry are associated with the analysis of the mineral composition of the human body, with particular emphasis on the properties of the elements of micro- and ultra-essential or toxic to living organisms. The main issues of bioorganic chemistry is to present characteristics of the main groups of compounds that are building blocks of living organisms - proteins, lipids, carbohydrates, nucleic acids. Particular emphasis is given to learn the conformation of molecules, which facilitate the understanding of the analysis of biological effects. During the course students learn the basics of practical work in the chemical laboratory and elements of qualitative, quantitative and instrumental analysis of organic and inorganic compounds.</p> <p>The last, pursued objective is to familiarize students with the basics of dental materials science, chemical structure and reactivity of substances applicable in dentistry.</p>
Prerequisite /essential requirements	Knowledge	Having a knowledge of chemistry at the high school level
	Skills	Ability to self-study in a targeted manner
	Competences	Ability to work effectively in a team

Description of the learning outcomes for the subject /module			
No. of learning outcome	Student, who has passed the (subject) knows /is able to /can:	SYMBOL (referring the standards)	Method of verification of learning outcomes*
W01	knows and understands importance of main and trace elements in processes within human body with regard to intake, absorption and transport	B.W1	W,K
W02	knows and understands importance of electrolytes, buffer systems and chemical reactions in biological systems	B.W2	
W03	knows and understands the biochemical foundations of the integrity of the human body	B.W3	
W04	knows and understands the structure and functions of important chemical compounds found in the human body, in particular properties, functions, metabolism and energy of reactions of proteins, nucleic acids, carbohydrates, lipids, enzymes and hormones	B.W4	
W05	knows role and importance of body fluids with regard to saliva	B.W6	
W06	knows and understands principles of acid-base equilibrium and transport of oxygen and carbon dioxide in human body	B.W21	
U01	knows how to refers chemical phenomena to processes going on in oral cavity	BU1	SL,PS
U02	knows how to use physical processes appropriate for the work of a dentist	BU3	
K01	recognizes its own limitations, self-assessing deficits and educational needs	K5	
K02	formulates conclusions from own measurements or observations	K8	

Table presenting LEARNING OUTCOMES in relation to the form of classes								
No. of learning outcome	Learning outcomes	Type of training						
		Lecture	Seminar	Practical classes	Clinical classes	Simulations	E-learning	Other...
W01	B.W1		X	X				
W02	B.W2		X	X				
W03	B.W3		X	X				
W04	B.W4		X	X				
W05	B.W6		X	X				
W06	B.W21		X	X				
U01	BU1			X				

U02	BU3			X				
K01	K5			X				
K02	K8			X				

**Table presenting TEACHING PROGRAMME**

No. of a teaching programme	Teaching programme	No. of hours	References to learning outcomes
<b>Winter semester</b>			
<b>Seminars</b>			
TK01	Chemical bonds in biological systems. Coordination binding. Complex compounds. Coordination chemistry of bioinorganic compounds. Hydrogen bond	1	BW1, BW4, U01, U02, K01
TK02	Water in the human body. Water structure and chemical properties. The effect of solutes on the properties of solutions. Diffusion and osmosis. Osmotic and tonic solutions. Donnan's balance. Water and electrolyte balance disorders.	1	BW2, BW3, BW6, U01, U02, K01
TK03	Free radical chemistry. Free radical formation. Reactive oxygen species. Hypochlorous acid and its derivatives. Nitric oxide and peroxynitrite. Free organic radicals. Inactivation of free radicals. The destructive effects of free radicals on the building blocks of cells. Positive activities of free radicals in the body. Antioxidative systems and substances.	2	BW3, U01, U02, K01
TK04	Lipids. Saturated and unsaturated fatty acids. Structure of triacylglycerols. Complex lipids: phospholipids (glycerophospholipids, sphingophospholipids), glycolipids. Chemistry and stereochemistry of the sterane system. Structure and physicochemical properties of cholesterol, cholic acid and bile acids.	1	BW4, U01, U02, K01
TK05	Heterocyclic compounds of physiological significance. Biologically important five- and six-membered heterocyclic compounds. Structure and physicochemical properties of nitrogenous bases.	1	BW4, U02, K01
TK06	Functions of elements in biological systems. Inorganic components found in the body.	2	BW1, BW3, U01, U02, K01
TK07	Acid-base balance. The concentration of hydrogen ions, the concept of pH and its criticism. Buffer solutions. Henderson-Hasselbalch equation. Buffer capacity. Effect of buffer solutions in open and closed systems.	2	BW2, BW6, BW21, U01, U02, K01
TK08	Water in the human body. Definition, properties of colloidal systems. Types of colloidal systems classification. Characteristics of lyophilic and lyophobic colloids. Structure of hydrophilic and hydrophobic colloid micelles. Coagulation and peptization.	2	BW2, BW3, BW6, U01, K01
TK09	Composition and chemical properties of saliva. Inorganic components, macro and microelements. Saliva as a buffering system.	2	BW3, BW6, U01, K01
TK10	Metals in dentistry. Metal properties. Metallic state. Metallic bonding properties. Amalgams. Properties of metals used in dentistry.	1	BW1, BW3, U02, K01

TK11	Carbohydrates. Polysaccharides with reserved and structural functions - structure and physicochemical properties. Sugar derivatives of biological importance: glycosides, homoglycans and heteroglycans. Glycoproteins and proteoglycans.	1	BW4, U01, U02, K01
TK12	Instrumental methods in (bio) chemical analysis. Properties of electromagnetic radiation. Absorption laws. Molecular spectroscopy. Absorption and emission atomic spectrometry. Classification of chromatographic methods.	1	BW2, U02, K01
<b>Practical classes</b>			
TK01	Calculations of concentration, dissociation constant and degree, pH and solubility product. Introduction to laboratory classes.	2	U02, K01, K02
TK02	Qualitative analysis of selected ions	4	BW1, U01, K01, K02
TK03	Properties of buffer solutions.	2	BW2, U01, U02, K01, K02
TK04	Donnan's equilibrium and properties of colloids.	2	BW2, U01, U02, K01, K02
TK05	Chemical properties and composition of saliva	2	BW3, BU1, U01, K01, K02
TK06	Structure and division of aminoacids. Peptide bond. Chemical properties of aminoacids.	2	BW4, U01, U02, K01, K02
TK07	Characteristics of chemical reactions. Thermodynamic state functions. Thermodynamic and kinetic reaction probability, endoergic and exoergic reactions, activation energy. Kinetics of chemical reactions. The effect of temperature on the course of the reaction. Kinetics of saccharose hydrolysis.	3	BW2, U01, U02, K01, K02
TK08	Carbohydrates. Physicochemical properties of monosaccharides. Carbohydrate isomerism types. Chemical properties and sugar detection.	3	BW4, U01, U02, K01, K02
TK09	Adsorption and partition chromatography of organic substances.	3	BW2, U02, K01, K02
<b>Booklist</b>			
<b>Obligatory literature:</b>			
1. J.Bober, B.Dołęgowska,D.Stańkowska-Walczak, <b>Chemistry for the First Year Students</b>			
<b>Supplementary literature:</b>			
1. Brady James E. , <b>Chemistry: The Study of Matter and its Changes</b>			

<b>Student's workload</b>	
Form of student's activity (in-class participation; activeness, produce a report, etc.)	Student's workload [h]
	Tutor
Contact hours with the tutor	40
Time spent on preparation to seminars/ practical classess	10
Time spent on reading recommended literature	20
Time spent on writing report/making project	5
Time spent on preparing to colloquium/ entry test	20
Time spent on preparing to exam	-
Other .....	-
Student's workload in total	95
<b>ECTS credits for the subject (in total)</b>	3
<b>Remarks</b>	

\* Selected examples of methods of assessment:

EP – written examination

EU –oral examination

ET – test examination

EPR – practical examination

K – colloquium

R – report

S – practical skills assessment

RZC – practical classes report, incl. discussion on results

O –student's active participation and attitude assessment

SL –lab report

SP – case study

PS - assessment of student's ability to work independently

W – entry test

PM – multimedial presentation

other...