


SYLLABUS OF THE ACADEMIC DISCIPLINE «Biological role of life elements»
1. General Information

Faculty	Faculty of Foreign Students
Programme	22 Healthcare, 222 Medicine, the second (master's) level of higher education, full-time
Academic year	2023-2024
Discipline, code (e-mail on the website of the Danylo Halytsky Lviv National Medical University)	Biological role of life elements, ББ 1.99, https://new.meduniv.lviv.ua/osvitni-programy/
Department (name, adress, phone number, e-mail)	Department of General, Bioinorganic, Physical and Colloidal Chemistry, 52 Pekarska str., Lviv, 79010 Telephone: +38 (032) 2754987, Shymzeriv str. 1a, Lviv, 79010 Telephone: +38 (032) 2786431, e-mail: kaf_genchemistry@meduniv.lviv.ua
Head of the Department (e-mail)	Iryna V. Drapak, DSc, PhD, Professor, e-mail: drapak_iryana@meduniv.lviv.ua
Academic year (year, when the study of the discipline is realized)	1
Semester (semester, when the study of the discipline is realized)	1
Type of the Subject (obligatory / selective)	selective
Professors	Olena Klenina, PhD in Pharmacy, Assoc. Professor, e-mail: olena_klenina@yahoo.com Marta Sulyma, PhD in Pharmacy, Assist. Professor, e-mail: sumarta145@gmail.com Oleksandra Roman, PhD in Pharmacy, Assoc. Professor, e-mail: lesia_roman@ukr.net Iryna Myrko, Assist. Professor, e-mail: irynaoliinyk@gmail.com

Erasmus <i>yes/no (availability of the discipline for students in framework of Erasmus+ program)</i>	no
Person, responsible for syllabus <i>(person, who is to be given comments concerning syllabus, contact e-mail)</i>	Oleksandra Roman, PhD in Pharmacy, Assoc. Professor, e-mail: lesia_roman@ukr.net
Quantity of ECTS credits	3
Quantity of hours <i>(lectures/ practical classes/ self-reliance work)</i>	12/18/60
Language of education	english
Information about consultations	Consultations take place according to the approved schedule, both offline (face-to-face) and online, using ICT available to students and teachers
2. Discipline overview	
The subjects of study of the discipline "Biological role of life elements" are the chemical basis of the life processes in the human body, which are subject to the basic chemical laws. The course provides a study of the structure and reactivity of the most important inorganic biologically active molecules, the theory of chemical bonds in complex compounds of biometals with bioligands and the role of nutrients in the body. Physicochemical processes that occur at the molecular and submolecular levels are also considered, because this is where the causes of various forms of disease and the specificity of hereditary traits.	
3. Discipline objectives	

1. **The goal of the academic discipline** is to form students' scientific worldview, develop modern forms of theoretical thinking and ability to analyze phenomena, develop skills and abilities to apply chemical laws and processes in future practice, competent use of chemicals and materials in the pharmaceutical industry.
2. **Discipline objectives** - to teach students to use the basic concepts of bioinorganic chemistry, basic laws of chemistry, general laws of chemical reactions, the doctrine of solutions, general information about chemical elements and their compounds, knowledge of physicochemical bases of different types of equilibria in biological systems in solving specific problems.
3. According to the requirements of the Educational Program, the discipline " Biological role of life elements " promotes the acquisition of students' competencies:
 - **general:**
 - ability to apply knowledge in practical situations;
 - the desire to preserve the environment;
 - ability to abstract thinking, analysis and synthesis, to learn and be modernly trained;
 - knowledge and understanding of the subject area and understanding of professional activity;
 - ability to evaluate and ensure the quality of work performed.
 - **special (professional, subject):**
 - ability to determine drugs, xenobiotics, toxins and their metabolites in biological fluids and tissues of the body, to conduct chemical and toxicological studies to diagnose acute poisoning, drug and alcohol intoxication.

4. Prerequisites of the Discipline

The study of the discipline "Biological role of life elements" is directly based on the basics of chemistry, elementary mathematics and physics in the scope of complete general secondary education.

5. Results of the Discipline

List of learning results

Code of the learning outcomes	The content of the learning outcomes	Matrix of competencies
3 _H – knowledges У _M – skills AB – independence and responsibility K – competence		ПП - program learning outcomes
3 _H -1	to know the safety rules when working in a chemical laboratory	<i>ПП3</i>
3 _H -2	to know qualitative reactions to ions of conditionally vital microelements	<i>ПП2, ПП4, ПП12, ПП18</i>
3 _H -3	to know qualitative reactions to ions of toxic elements	<i>ПП2, ПП4, ПП12, ПП18</i>
3 _H -4	to know the qualitative reactions to ions of potentially toxic elements	<i>ПП2, ПП4, ПП12, ПП18</i>

3H-5	to know qualitative reactions to ions of nonmetals microelements	<i>PP2, PP4, PP12, PP18</i>
3H-6	to know qualitative reactions to ions of metals microelements	<i>PP2, PP4, PP12, PP18</i>
3H-7	to know qualitative reactions to ions of nonmetals macroelements	<i>PP2, PP4, PP12, PP18</i>
3H-8	to know qualitative reactions to ions of metals macroelements	<i>PP2, PP4, PP12, PP18</i>
3H-9	to know the chemical composition of cells, blood and plasma	<i>PP2, PP4, PP12, PP18</i>
3H-10	to know the concept of "human microelementosis"	<i>PP2, PP4, PP12, PP18</i>
3H-11	to know the concepts of "metal-ligand homeostasis", "metal-ligand pathologies", "bioligand", "chelation therapy"	<i>PP2, PP4, PP12, PP18</i>
3H-12	to know the mechanism of action of complexones as drugs	<i>PP2, PP4, PP12, PP18</i>
3H-13	to know the methods of assessing the elemental status of human	<i>PP2, PP4, PP12, PP18</i>
3H-14	to know the methods of using metals as probes in biochemical research	<i>PP2, PP4, PP12, PP18</i>
3H-15	to know the medicines of metals, metalloids and non-metals	<i>PP2, PP4, PP12, PP18</i>
3H-16	to know the classification of chemical elements	<i>PP2, PP4, PP12, PP18</i>
3H-17	to know the importance of acid-base homeostasis for the human body	<i>PP2, PP4, PP12, PP18</i>
3H-18	to know the teachings of V. Vernadsky on the biosphere	<i>PP2, PP4, PP12, PP18</i>
3H-19	to know the biological significance, toxic effects, content in the body, application in medicine of potentially toxic elements	<i>PP2, PP4, PP12, PP18</i>
3H-20	to know the biological significance, toxic effects, content in the body, application in medicine of toxic elements	<i>PP2, PP4, PP12, PP18</i>
3H-21	to know the biological significance, content in the body, application in medicine for Oxygen	<i>PP2, PP4, PP12, PP18</i>
3H-22	to know the biological significance, content in the body, application in medicine of Hydrogen	<i>PP2, PP4, PP12, PP18</i>
3H-23	to know the biological significance, content in the body, application in medicine of Nitrogen	<i>PP2, PP4, PP12, PP18</i>
3H-24	to know the biological significance, content in the body, application in medicine of Phosphorus	<i>PP2, PP4, PP12, PP18</i>
3H-25	to know the biological significance, content in the body, application in medicine of Sulfur	<i>PP2, PP4, PP12, PP18</i>
3H-26	to know the biological significance, content in the body, application in medicine of Chlorine	<i>PP2, PP4, PP12, PP18</i>
3H-27	to know the biological significance, content in the body, application in medicine of Calcium	<i>PP2, PP4, PP12, PP18</i>
3H-28	to know the biological significance, content in the body, application in medicine of Potassium	<i>PP2, PP4, PP12, PP18</i>
3H-29	to know the biological significance, content in the body, application in medicine of Sodium	<i>PP2, PP4, PP12, PP18</i>
3H-30	to know the biological significance, content in the body, application in medicine of Magnesium	<i>PP2, PP4, PP12, PP18</i>
3H-31	to know the biological significance, content in the body, application in medicine of Iron	<i>PP2, PP4, PP12, PP18</i>
3H-32	to know the biological significance, content in the body, application in medicine of Zinc	<i>PP2, PP4, PP12, PP18</i>
3H-33	to know the biological significance, content in the body, application in medicine of Copper	<i>PP2, PP4, PP12, PP18</i>
3H-34	to know the biological significance, content in the body, application in medicine of Manganese	<i>PP2, PP4, PP12, PP18</i>
3H-35	to know the biological significance, content in the body, application in medicine of Molybdenum	<i>PP2, PP4, PP12, PP18</i>
3H-36	to know the biological significance, content in the body, application in medicine of Cobalt	<i>PP2, PP4, PP12, PP18</i>
3H-37	to know the biological significance, content in the body, application in medicine of Chrome	<i>PP2, PP4, PP12, PP18</i>
3H-38	to know the biological significance, content in the body, application in medicine of Iodine	<i>PP2, PP4, PP12, PP18</i>
3H-39	to know the biological significance, content in the body, application in medicine of Selenium	<i>PP2, PP4, PP12, PP18</i>
3H-40	to know the biological significance, content in the body, application in medicine of Fluorine	<i>PP2, PP4, PP12, PP18</i>

3H-41	to know the biological significance, content in the body, application in medicine of Boron	PP2, PP4, PP12, PP18
3H-42	to know the biological significance, content in the body, application in medicine of Silicon	PP2, PP4, PP12, PP18
3H-43	to know the biological significance, content in the body, application in medicine of Bromine	PP2, PP4, PP12, PP18
3H-44	to know the biological significance, content in the body, application in medicine of Nicole	PP2, PP4, PP12, PP18
3H-45	to know the biological significance, content in the body, application in medicine of Vanadium	PP2, PP4, PP12, PP18
3H-46	to know the biological significance, content in the body, application in medicine of Arsenic	PP2, PP4, PP12, PP18
3H-47	to know the biological significance, content in the body, application in medicine of Lithium	PP2, PP4, PP12, PP18
3H-48	to know the basic measures to prevent infection and spread of COVID-19 caused by SARS-CoV-2 virus, and properly implement them in higher education	PP-2, PP-3
YM-1	to be able to calculate and determine oncotic pressure	PP2, PP3, PP4, PP12, PP18
YM-2	to be able to carry out qualitative reactions to ions of conditionally vital microelements	PP2, PP3, PP4, PP12, PP18
YM-3	to be able to carry out qualitative reactions to ions of toxic elements	PP2, PP3, PP4, PP12, PP18
YM-4	to be able to conduct qualitative reactions to ions of potentially toxic elements	PP2, PP3, PP4, PP12, PP18
YM-5	to be able to carry out qualitative reactions on ions of microelements of nonmetals	PP2, PP3, PP4, PP12, PP18
YM-6	to be able to carry out qualitative reactions on ions of microelements of metals	PP2, PP3, PP4, PP12, PP18
YM-7	to be able to perform qualitative reactions on ions of macroelements of nonmetals	PP2, PP3, PP4, PP12, PP18
YM-8	to be able to perform qualitative reactions on ions of macroelements of metals	PP2, PP3, PP4, PP12, PP18
YM-9	to be able to explain the migration of bioelements in nature and the human body	PP2, PP3, PP4, PP12, PP18
YM-10	to be able to classify chemical elements	PP2, PP3, PP4, PP12, PP18
YM-11	to be able to suggest possible ways to correct metal-ligand homeostasis	PP2, PP3, PP4, PP12, PP18
YM-12	to be able to suggest possible ways to correct acid-base homeostasis	PP2, PP3, PP4, PP12, PP18
YM-13	to be able to experimentally obtain chelated compounds of toxic metals	PP2, PP3, PP4, PP12, PP18
YM-14	to be able to experimentally obtain some coordination compounds of metals	PP2, PP3, PP4, PP12, PP18
YM-15	to be able to establish a relationship between the properties of bioelements and their position in the periodic table	PP2, PP3, PP4, PP12, PP18
YM-16	to be able to determine blood pH	PP2, PP3, PP4, PP12, PP18
K-1	ability to apply knowledge in practical situations	PP2, PP3, PP4, PP12, PP18
K-2	ability to abstract thinking, analysis and synthesis, ability to learn and be modernly trained	PP2, PP3, PP4, PP12, PP18
K-3	knowledge and understanding of the subject area	PP2, PP3, PP4, PP12, PP18
K-4	ability to evaluate and ensure the quality of performed work	PP2, PP3, PP4, PP12, PP18
K-5	ability to organize activities for the preparation of solutions	PP2, PP3, PP4, PP12, PP18
K-6	ability to organize activities for planning and performing simple chemical experiments	PP2, PP3, PP4, PP12, PP18
K-7	the ability to predict the chemical properties of an element and its compounds depending on its position in the periodic table	PP2, PP3, PP4, PP12, PP18
AB-1	to be responsible for making decisions in difficult conditions	PP2, PP3, PP4, PP12, PP18
AB-2	to be responsible for the timely acquisition of modern knowledge	PP2, PP3, PP4, PP12, PP18
AB-3	to be responsible for the quality of work	PP2, PP3, PP4, PP12, PP18

AB-4	independence, responsibility	ПП2, ПП3, ПП4, ПП12, ПП18
6. Discipline format and content		
Course format (specify full-time or part-time)	Full-time Discipline	
Classes	Hours	Groups
Lectures	12	6
Practical	18	6
Seminars	–	–
Individual	60	
7. Topics and content of the Discipline		

Code of the classes type	Topic	Content	Code of the learning outcomes	Professor
II-1/II-1/CPC-1	Chemical elements in the geosphere and biosphere. The position of nutrients in the Periodic Table. The concept of human microelementosis	<p>Classifications of chemical elements. Biogenic elements. Macro- and microelements. The position of nutrients in the periodic system of DI Mendeleev. Relationship of physicochemical parameters of elements with their position in the periodic table and content in the body. Properties and biological role of some s-, p- and d-elements.</p> <p>V. Vernadsky's doctrine of the biosphere and biogeochemistry. The concept of migration of chemical elements. Association of endemic diseases with features of biogeochemical provinces. Human and the biosphere. The noosphere. Technological progress and ecology.</p> <p>Human microelementosis as a pathological process caused by deficiency, excess or imbalance of macro- and microelements. Indications for laboratory diagnosis. Biochemical indicators of human elemental status.</p>	3H-1, 3H-10, 3H-13, 3H-16, 3H-18, YM-9, YM-10, YM-15, K-1, K-2, K-3, K-4, K-5, K-6, AB-1, AB-2, AB-3, AB-4	O.Klenina O.Roman M.Sulyma I.Myrko
II-2/II-1/CPC-2	The chemical composition of cells and blood, the function of	<p>The chemical composition of the cell. General characteristics of macro- and microelements of the cell. Their biological significance.</p> <p>Inorganic compounds in the cell. Influence of water in the activity of cells of a living</p>	3H-9, 3H-17, YM-1, YM-12, YM-16, K-1, K-2, K-3, K-4, K-5, AB-1, AB-	

	individual elements in them	<p>organism. The role of mineral salts in the cell.</p> <p>Organic compounds in the cell and their biological significance.</p> <p>Blood and its functions, components of blood. Blood volume (total, circulating (BCC), deposited). Blood viscosity. Relative density of blood (value, size).</p> <p>Plasma, its composition, the role of plasma proteins. Osmotic and oncotic pressures. Functional system that maintains the stability of the osmotic pressure. The concept of physiological isotonic solutions; hypertonic and hypotonic solutions. Hemorrhagic fluids.</p> <p>Acid-base homeostasis, its significance for the body. Physico-chemical mechanisms that maintain acid-base balance in the body. Physiological mechanisms of homeostatic regulatory functions of the kidneys, lungs, liver, gastrointestinal tract and bone tissue. Buffer systems of the internal environment of the organism. Functional system that maintains acid-base homeostasis.</p>	2, AB-3, AB-4	
II-3/II-2/CPC-3	Bioelements organogens (O, C, H, N). Non-metallic macronutrients (P, S, Cl)	<p>Oxygen. General characteristics, distribution in nature, biological role. Chemical bases of oxygen and ozone application in medicine.</p> <p>Carbon, biological significance. Carbon allotropy. Carbon (II) compounds. Carbon monoxide, its acid-base and redox characteristics. Carbon monoxide as a ligand, the chemical basis of its toxicity. Chemical bases of application of Carbon and its compounds in medicine.</p> <p>Hydrogen. General characteristics of the element, biological significance. Features of the situation in the periodic system of elements. Chemical bases of Hydrogen and its compounds application in medicine.</p> <p>Nitrogen. General characteristics, biological significance. Compounds with different values of oxidation states. Chemical bases of Nitrogen and its compounds application in medicine.</p> <p>Phosphorus. General characteristics, biological significance. Allotropic modifications of Phosphorus, their chemical activity. Qualitative reaction to phosphate ion. Chemical bases of application of Nitrogen and its compounds in medicine.</p> <p>Sulfur. General characteristics. Biological role of sulfur (sulfhydryl groups and disulfide</p>	3H-7, 3H-8, 3H-16, 3H-21, 3H-22, 3H-23, 3H-24, 3H-25, 3H-26, VM-7, K-1, K-2, K-3, K-4, K-5, AB-1, AB-2, AB-3, AB-4	

		<p>bridges in proteins). Sulphides of metals and nonmetals, their solubility in water and hydrolysis. Qualitative reactions on sulfur-containing ions. Chemical bases of Sulfur and its compounds application in medicine.</p> <p>General characteristics of Chlorine as a representative of halogens. Chlorine compounds with metals and nonmetals. Biological role of chlorine compounds. The application of chlorinated lime, chlorinated water, active chlorine preparations in medicine, sanitation.</p>	
II-4/JI-2/CPC-4	Macroelements metals (Ca, K, Na, Mg)	<p>General characteristics of s-elements of IA and IIA groups. Distribution in nature. Chemical properties of s-elements. General information about nutrients. Qualitative and quantitative content of nutrients in the human body. Biological role of elements in the mineral balance of the organism. Macroelements, their content in the body. Ionophores and their role in membrane transport of potassium and sodium ions. Characteristics of the ionic state of these elements. The use of sodium and potassium compounds in medicine. Biological role of Calcium and Magnesium. Chemical bases of application of compounds of Magnesium, Calcium in medicine.</p>	<p>3H-8, 3H-16, 3H-27, 3H-28, 3H-29, 3H-30, VM-8, K-1, K-2, K-3, K-4, K-5, AB-1, AB-2, AB-3, AB-4</p>
II-5/JI-3/CPC-5	Microelements metals (Fe, Zn, Cu, Mn, Mo, Co, Cr)	<p>General characteristics of iron, zinc, copper, manganese, molybdenum, chromium and cobalt, ionic states, coordination numbers, chemical activity of their simple substances, natural compounds.</p> <p>Acid-base and redox characteristics of compounds of Iron, Zinc, Copper, Manganese, Molybdenum, Chromium and Cobalt. Salts of these biometals, their solubility and hydrolysis, thermal decomposition of nitrates. Complex compounds Zn, Fe, Cu, Co, Cr, Mn, Mo with ammonia, water, hydroxide ions, amino acids and polyhydric alcohols, cyanide and thiocyanate ions, dimethylglyoxime and porphyrins. Qualitative reactions to the detection of these metals. The composition and biological significance of enzymes containing Zn, Fe, Cu, Co, Cr, Mn, Mo. The use of compounds of Iron, Zinc, Copper, Manganese, Molybdenum, Chromium and Cobalt in pharmaceutical analysis and medicine. Diseases caused by deficiency and excess of these bioelements.</p>	<p>3H-6, 3H-16, 3H-31, 3H-32, 3H-33, 3H-34, 3H-35, 3H-36, 3H-37, VM-6, K-1, K-2, K-3, K-4, K-5, AB-1, AB-2, AB-3, AB-4</p>
II-6/JI-3/CPC-6	Microelements nonmetals (Se, I)	<p>Selenium: general characteristics, acid-base and redox properties of compounds. The biological role of selenium. The concept of antioxidants.</p> <p>Iodine: general characteristics as an element of group VIII. Iodide ions as ligands in</p>	<p>3H-5, 3H-16, 3H-38, 3H-39, VM-5, K-1, K-2, K-3, K-4, K-5, AB-1, AB-</p>

		<p>complex compounds. Iodide ion detection reactions.</p> <p>Biological role of iodine compounds. The concept of chemistry of bactericidal action of iodine. The use of active iodine, as well as iodides in medicine, sanitation.</p>	<p>2, AB-3, AB-4</p>
II-7/II-4/CPC-7	<p>Conditionally vital microelements nonmetals, metals and metalloids (F, B, Si, Br, Ni, V, As, Li)</p>	<p>Special properties of fluorine as the most electronegative element. Simple substances, their chemical activity.</p> <p>General characteristics of Boron. Simple substance and its chemical activity. Biological role of boron. Antiseptic properties of boric acid and its salts.</p> <p>Silicon. General characteristics, biological role. The main difference between Silicon and Carbon is the absence of π-bonds in the compounds. Chemical bases of application of silicon compounds in medicine.</p> <p>Physiological role of Fluorine, Boron, Silicon and Bromine. Indicators of elemental status in the human body. Correction of excess and deficiency of elements in the body. The use of compounds of these elements in medicine, sanitation.</p> <p>General characteristics of the elements Lithium, Nicholas, Vanadium and Arsenic. Valence states. Chemical activity. Distribution in nature. Their binary compounds (superoxides, ozonides). Hydroxides, salts of Li, Ni, V, As and their properties and applications in medicine.</p> <p>Determination of Arsen by the March method.</p> <p>The most important compounds of Nicholas (II). Hydrolysis of salts of Nicholas (II). Complex compounds, coenzyme B12. Qualitative reaction on the Ni⁺² cation.</p>	<p>3H-2, 3H-16, 3H-40, 3H-41, 3H-42, 3H-43, 3H-44, 3H-45, 3H-46, 3H-47, VM-2 K-1, K-2, K-3, K-4, K-5, AB-1, AB-2, AB-3, AB-4</p>
II-8/II-4/CPC-8	<p>Potentially toxic and toxic microelements (Rb, Ag, Au, Zr, Sn, W, Ge, Ga, Sr, Ti, Al, Pb, Ba, Bi, Cd, Hg, Tl, Be, Sb)</p>	<p>General characteristics of potentially toxic microelements. Distribution in nature. Biological role of elements in the mineral balance of the organism. General characteristics of the elements. Features of the situation in the periodic system of elements. Physiological role of potentially toxic microelements. Ways of entry into the human body. Causes of high content of potentially toxic microelements in the human body. The main manifestations of potentially toxic microelements excess in the human body. Correction of potentially toxic microelements excess in the human body.</p>	<p>3H-3, 3H-4, 3H-16, 3H-19, 3H-20, VM-3, VM-4, K-1, K-2, K-3, K-4, K-5, AB-1, AB-2, AB-3, AB-4</p>

		<p>General characteristics of toxic microelements. Distribution in nature. Biological role of elements in the mineral balance of the organism. Characteristics of the ionic state of these microelements.</p> <p>Toxic microelement poisoning, toxicity threshold, toxic and lethal doses. Manifestations of toxicity and physiological role. Increased and decreased content of toxic microelements. Environmental pollution. Sources of elements in the human body. The ability of toxic microelements to form stable complexes. Chemical bases of application in medicine and cosmetology.</p>		
II-9/II-5/CPC-9	The unity of the chemical composition of the organism. Metal-ligand homeostasis and its correction	<p>The essence of the chemical composition of the organism unity and its significance and the theory of metal-ligand pathologies. Pathologies in the life of the human body associated with abnormal content of certain chemical elements.</p> <p>The most important bioligands, their isomerism. Basic elements and functional groups in the composition of bioligands. Ligand properties of complexones and drugs. Chelation therapy.</p>	3H-11, 3H-12, 3H-20, VM-11, VM-13, K-1, K-2, K-3, K-4, K-5, AB-1, AB-2, AB-3, AB-4	
II-10/II-5/CPC-10	Inorganic drugs based on coordination compounds	<p>Drugs based on metals and metalloids. Application of inorganic compounds of Oxygen, Sulfur, Chlorine, Bromine, Nitrogen in medicine. Drugs based on coordination compounds of non-metals and metalloids (Boron, Phosphorus, Antimony, Arsenic, Selenium, Tellurium).</p> <p>Medicines based on metals and coordination compounds of metals (Mg, Ca, Al, Cu, Ag, Hg, Zn, Au). The use of metals as probes in biochemical research.</p>	3H-15, 3H-14, VM-14 K-1, K-2, K-3, K-4, K-5, AB-1, AB-2, AB-3, AB-4	

8. Verification of results

Current control

Is performed during practical classes and aims to check the assimilation of students of educational material (it is necessary to describe the forms of current control during training sessions). Forms of assessment of current educational activities should be standardized and include control of theoretical and practical training. The final grade for the current educational activity is set on a 4-point (national) scale

Learning outcome code	Code of classes type	The method of learning outcomes verification	Criteria of evaluation
3H-1, 3H-2, 3H-3, 3H-4, 3H-5, 3H-6, 3H-7, 3H-8, 3H-9, 3H-10, 3H-11, 3H-12, 3H-13, 3H-14, 3H-15, 3H-16, 3H-17, 3H-18, 3H-	II-1, II-1, CPC-1, II-2, CPC-2, II-3, II-2, CPC-3, II-4,	At each practical lesson, the student answers a test which includes 15 questions (1 point for the correct answer). Each test on the topic of the relevant practical lesson includes standardized questions, knowledge of	The minimum number of points required for enrollment is 8.

19, 3H-20, 3H-21, 3H-22, 3H-23, 3H-24, 3H-25, 3H-26, 3H-27, 3H-28, 3H-29, 3H-30, 3H-31, 3H-32, 3H-33, 3H-34, 3H-35, 3H-36, 3H-37, 3H-38, 3H-39, 3H-40, 3H-41, 3H-42, 3H-43, 3H-44, 3H-45, 3H-46, 3H-47, YM-1, YM-9, YM-10, YM-11, YM-12, YM-15, K-1, K-2, K-3, K-6, AB-2, AB-4	CPC-4, П-5, Л-3, CPC-5, П-6, CPC-6, П-7, Л-4, CPC-7, П-8, CPC-8, П-9, Л-5, CPC-9, П-10, CPC-10	which is necessary to understand the current topic, the material of the lecture course and independent work.	
3H-1, YM-1, YM-2, YM-3, YM-4, YM-5, YM-6, YM-7, YM-8, YM-13, YM-14, YM-15, YM-16, K-1, K-2, K-3, K-4, K-5, K-6, AB-1, AB-2, AB-3, AB-4	П-1, П-2, П-3, П-4, П-5, П-6, П-7, П-8, П-9, П-10	The control of laboratory researches and mastering of practical skills is carried out after performance of laboratory work, by an estimation of quality and completeness of its performance, ability to interpret the received results which are reflected in the report on the performed laboratory work. For the performed laboratory work the student can type: <ul style="list-style-type: none"> - 4 points, if the laboratory work is performed in full and the student freely and correctly explains the research and gives them an assessment; - 2 points, if the laboratory work is performed with some errors, the student can not fully explain the research and give them an assessment; - 0 points if the laboratory work is not performed or the student can not explain the research and give them an assessment. 	The minimum number of points required for enrollment - 2
Final control			
General evaluation system	participation in the work during the semester / exam - 60% / 40% on a 200-point scale		
Rating scales	traditional 4-point scale, multi-point (200-point) scale, ECTS rating scale		
Conditions of admission to the final control	the student attended all practical (laboratory, seminar) classes and received at least 120 points for current performance		
Type of final control	Methods of final control		Enrollment criteria
Test	All topics submitted for current control must be included. Grades from the 4-point scale are converted into points on a multi-point (200-point) scale in accordance with the Regulation "Criteria, rules and procedures for evaluating the results of student learning activities" The calculation of the number of points is based on the grades obtained by the student on a 4-point (national) scale during the study of the discipline, by calculating the arithmetic mean		<i>The maximum number of points is 200.</i> <i>The minimum number of points is 120</i>

(CA), rounded to two decimal places. The resulting value is converted into points on a multi-point scale as follows:

$$x = \frac{CA \times 200}{5}$$

9. Discipline policy

When organizing the educational process, students, teachers and administration act in accordance with:

Regulations on the organization of the educational process (<https://cutt.ly/3ySk64r>);

Regulations on evaluation criteria and rules (<https://cutt.ly/lySlyw0>);

Regulations on academic integrity (<https://cutt.ly/EySkNHu>)

10. Recommended literature

Required discipline textbooks:

1. V.O. Kalibabchuk, V.I. Halynska, L.I. Hryshchenko et al. Medical Chemistry. – AUS MEDICINE Publishing. – 2010. – 224 p.
2. General and Inorganic Chemistry : textbook / V.O. Kalibabchuk, V.V. Ohurtsov, V.I. Halynska et al. ; edited by V.O. Kalibabchuk. – Kyiv : AUS Medicine Publishing, 2019. – 456 p.
3. Raymond Chang. Chemistry (6th Edition). – WCB/McGraw-Hill. – 1998. – 995 p.
4. Steven S. Zumdahl. Chemistry (4th Edition). – Houghton Mifflin Company. – 1997. – 1031 p.
5. Gary L. Miessler, Donald A. Tarr. Inorganic Chemistry. – Prentice Hall. – 1991. – 625 p.

Additional books:

6. Rodney J. Sime Physical Chemistry. Methods. Techniques. Experiments. – Saunders College Publishing. – 1990. – 806 p.
7. John McMurry, Robert C. Fay. Chemistry (3rd Edition). – Prentice Hall. – 2001. – 1067 p.
8. David E. Goldberg. Fundamentals of Chemistry (2nd Edition). – WCB/McGraw-Hill. – 1998. – 561 p.
9. Theodore L. Brown, H.Eugene LeMay, Bruce E. Bursten. Chemistry. The Central Science. – Prentice Hall. – 2000. – 1017 p.
10. John Olmsted III, Gregory M. Williams. Chemistry. The Molecular Science. – Mosby. – 1994. – 977 p.

11. Equipment, logistics and software for discipline

The department is provided with classrooms for training sessions and control activities on the discipline in small groups. Lecture halls are equipped with multimedia equipment. Educational and scientific laboratories equipped with the necessary chemical utensils, reagents and devices are used to perform laboratory work and practice practical skills.

12. Additional Information

Responsible for the educational process at the department – Marta Sulyma, Assistant Professor, e-mail: sumarta145@gmail.com.

The department has a student research group, the direction of which is the synthesis of new BAS and analysis of newly synthesized compounds and drugs.

Students should wear medical gowns and hats during lectures and workshops.

Classes are held in the classrooms of the department at the following addresses: Lviv, 52 Pekarska Street, Chemical Building; Lviv, street Shimzeriv, 1a, Theoretical building, 4th floor.

Department website: kaf_genchemistry@meduniv.lviv.ua

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