



Syllabus on the discipline “Medical Chemistry”

1. General information	
Faculty	Faculty of Medicine
Educational program (<i>field, speciality, level of high education, form of education</i>)	22 Healthcare, 228 Pediatrics, second (Master’s) level of higher education, full-time
Academic year	2023-2024
Discipline title, code (<i>electronic identification at the Danylo Halytsky Lviv National Medical University website</i>)	Medical Chemistry, OK 10, https://new.meduniv.lviv.ua/kafedry/kafedra-zagalnoyi-bioneorganichnoyi-fizkoloynoyi-himiyi/
Department (<i>name, address, phone, e-mail</i>)	Department of General, Bioinorganic, Physical and Colloidal Chemistry, 79010, Lviv, 52 Pekarska Str. ph.: +38 (032) 2754987; 79010, Lviv, 1a Shymzeriv Str., ph.: +38 (032) 2786431, e-mail: kaf_genchemistry@meduniv.lviv.ua
Head of the Department (<i>contact e-mail</i>)	Iryna V. Drapak, Professor, Doctor of Sciences in Pharmacy, e-mail: drapak_iryana@meduniv.lviv.ua
Educational year (<i>year of the discipline study</i>)	1 st
Semester (<i>semester of the discipline study</i>)	1 st
Type of the discipline/module (<i>mandatory/ optional</i>)	Mandatory
Teaching staff (<i>names, surnames, scientific degrees and titles of the teaching staff, contact e-mails</i>)	Olena Klenina, PhD in Pharmacy, Associate Professor; olena_klenina@yahoo.com Oleksandra Roman, PhD in Pharmacy, Associate Professor; lesia_roman@ukr.net Marta Syluma, PhD in Pharmacy, sumarta145@gmail.com Iryna Myrko; irynaoliinyk@gmail.com
Erasmus yes/no (<i>availability of discipline for students within the program Erasmus+</i>)	no

Person, responsible for syllabus (<i>the person to whom comments on the syllabus should given, contact e-mail</i>)	Olena Klenina, PhD in Pharmacy, Associate Professor; olena_klenina@yahoo.com
Number of ECTS credits	4
Number of hours (<i>lectures/ practical classes/ self-reliance work</i>)	16/44/60
Language of studying	English
Information on the academic advising	Consultations are held in accordance with the schedule, approved by the Chair of the department, in either offline (face-to-face) mode or online, using information computer technologies available to students and teaching staff
Address, telephone and rules of operation of the clinical base, office (<i>is necessary</i>)	–

2. Brief course overview

Medical chemistry is one of the fundamental natural sciences disciplines in higher medical education, the knowledge of its bases is essential for productive and creative work of experts in the field of health care. It develops the dialectical way of thinking, expands and deepens the scientific knowledges about matter, structure and properties of chemical compounds and the regularities of their interaction and transformation in living organism, and identifies the ways of applied problems solving in the health care sector. The knowledges on medical chemistry will enable the future specialist to acquire skills most essential for qualitative and quantitative prediction of biochemical processes occurrence probability and physicochemical principles of various types of equilibria in biological systems interpretation.

Medical chemistry is organized around the knowledge of the chemical foundations of the vital functioning processes of the organism, which obey the basic chemical laws. Medical chemistry examines the structure and reactivity of the most important biologically active molecules, the theory of chemical bonding in coordination compounds of biometals with bioligands and the role of biogenic elements in the life of the organism. The studying of Medical chemistry generates basic understanding of physical and chemical processes that take place at the molecular and sub-molecular levels as the possible reasons for various forms of diseases and the specificity of hereditary symptoms.

3. The objective and tasks of the discipline

1. **Objective** of the discipline “Medical chemistry” studying is the scientific outlook of students formation, the contemporary forms of their theoretical thinking development and the ability to analyze phenomena, the skills and abilities formation for the chemical and physico-chemical laws and processes application during the other disciplines studying and in future practical activities.
2. **Tasks of the discipline** is to teach students to use the basic concepts of chemistry, the basic laws of chemistry, the general regularities of the chemical reactions proceeding, the theory of solutions, the general knowledge about chemical elements and their compounds, knowledge of the physico-chemical foundations of various types of equilibria in biological systems in solving specific problems in medicine in accordance with modern requirements.
3. The course provides the students’ **competences** according to the requirements of the High education standard:

integral:

- The ability to apply the acquired general and professional competences to solve complex tasks of the professional activity of a pediatrician and practical problems in the field of health care in the relevant position, the scope of which is provided by the specified lists of syndromes and symptoms of diseases, emergency conditions, physiological conditions and diseases that require special patient management tactics; laboratory and instrumental research, medical manipulations; issues of judicial and military expertise and/or implementation of innovations. The ability to solve complex problems, including those of a research and innovation nature in the field of medicine (pediatrics). Ability to continue learning with a high degree of autonomy.

general:

- The ability to abstract thinking, analysis and synthesis (GC1).
- The ability to apply knowledge in practical situations (GC3).
- Knowledge and understanding of the subject area and understanding of professional activity (GC4).
- The ability to make informed decisions (GC6).
- The ability to search, process and analyze information from various sources (GC11).
- Determination and perseverance regarding the assigned tasks and assumed responsibilities (GC12).
- The ability to realize the rights and responsibilities as a member of society, to be aware of the values of civil (free democratic) society and the need for its sustainable development, the rule of law, rights and freedoms of a person and a citizen in Ukraine (GC14).

specific (professional, subject-specific):

- The ability to determine the necessary list of laboratory and instrumental research and to evaluate their results (PC2).
- The ability to determine the nature of nutrition in the treatment and prevention of diseases (PC5).
- The ability to determine the principles and nature of treatment and prevention of diseases (PC6).
- The ability to diagnose emergency states (PC7).
- The ability to organize and integrate the provision of medical care to the population and marketing of medical services (PC19).

4. Prerequisites of the discipline

The studying of the discipline "Medical Chemistry" is based directly on the knowledge of chemistry in the secondary education extent, as well as the fundamentals of elementary mathematics and physics.

5. Program results of study

List of results of study

Code of the learning outcomes	The content of the learning outcomes	Link to the competencies matrix code
<i>Code is created while filling out the syllabus (categories: Kn – knowledge, Ab</i>	<i>Results of study determine that the student must know, understand and be able to perform, after completing the discipline. Results of study follow from the set learning goals. To enroll in the discipline, it is necessary to confirm the achievements of each result of study.</i>	<i>Symbol of the Program Result of Study (PRS) Code in the Higher Education Standard</i>

– ability, C – competence, AR – autonomy and responsibility)		
<i>Kn-1</i>	to know the safety rules in chemical laboratory	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-2</i>	to know the variables influencing the solubility of substances	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-3</i>	to know the role of solutions in life	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-4</i>	to know the ways of expressing concentration of solutions	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-5</i>	to know colligative properties of solutions	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-6</i>	to know basic statements of coordination theory	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-7</i>	to know the structure of molecules and chemical properties of coordination compounds	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-8</i>	to know the chemical properties of the macro- and microelements, based on their position in the periodic system	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-9</i>	to know the biological role of macro-, microelements and use of their compounds in medical practice	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-10</i>	to know main types of reactions which characterize the chemical properties of microelements	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-11</i>	to know biological role of microelements and drugs, for which microelements are the part of their molecules composition	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-12</i>	to know toxic effects of some xenobiotics	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-13</i>	to know the theory of weak and strong electrolytes	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-14</i>	to know the normal and pathology pH values for fluids of the human body	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-15</i>	to know the meaning of term "percent of electrolytic dissociation", "dissociation constant", "pH value", "Solubility product constant"	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-16</i>	to know the types of protolytic processes	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-17</i>	to know the role of hydrolysis in biochemical processes	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-18</i>	to know the concept of buffer systems, their composition, types and the mechanism of their action	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-19</i>	to know formulas for the pH calculating of buffer systems	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-20</i>	to know the concept of buffer capacity and the formulas for its value calculating	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-21</i>	to know the theoretical basis of the acid-base titration method	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-22</i>	to know the calculations procedures in titration analysis	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-23</i>	to know the standardization methods for titrated solutions	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-24</i>	to know basic concepts and laws of thermochemistry	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Kn-25</i>	to know basic concepts and laws of chemical kinetics, mechanisms of chemical and some biochemical reactions and features of enzymes as biological catalysts	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>

Kn-26	to know features of chemical equilibrium in heterogeneous systems, the conditions of its shifting	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-27	to know mechanism of electrode potentials occurrence	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-28	to know the principles and limitations of potentiometers (pH meters) application for potentiometric purposes	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-29	to know the importance of surface phenomena in biology and medicine	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-30	to know physico-chemical bases of adsorption therapy methods	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-31	to know properties of lyophobic sols	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-32	to know micellar structure of colloidal particles	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-33	to know the laws of light scattering in colloidal systems	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-34	to know electrical properties of colloidal systems	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-35	to know application of electrophoresis in medical and pharmaceutical research	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-36	to know what factors can cause coagulation	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-37	to know the essence of the colloidal protection phenomenon	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-38	to know the role of colloidal protection in biology, medicine, pharmacy	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-39	to know basic methods of high molecular weight compounds obtaining	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-40	to know the structure of molecules of natural and synthetic high molecular weight compounds	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Kn-41	<i>to know the classification of disinfectants and antiseptics by the main active substances and their concentration in working solutions</i>	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-1	be able to to prepare solutions of given concentrations	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-2	be able to determine the factor of equivalence, molar mass and equivalent mass of simple and complex compounds	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-3	be able to prepare hypo-, hyper- and isotonic solutions and know their application in medicine	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-4	be able to to determine some of substances' parameters with cryometry method	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-5	be able to to explain such phenomena as plasmolysis, hemolysis, turgor	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-6	be able to write down formulas of coordination compounds, give their systematic nomenclature names	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-7	be able to write down equations for coordination compounds formation reactions and characterize coordination compounds stability	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-8	be able to carry out reactions that characterize the acid-base and redox properties of bioelements	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
Ab-9	be able to carry out qualitative identification reactions of Na^+ , K^+ , Mg^{2+} , Ca^{2+} , CO_3^{2-} , PO_4^{3-} , NO_3^- , NO_2^- ions	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6

<i>Ab-10</i>	be able to carry out identification reactions which allow to define the microelements ions in bioliquids and mixtures	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-11</i>	be able to experimentally determine the pH value of different salt solutions	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-12</i>	be able write down ionic and molecular equations of hydrolysis	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-13</i>	be able to experimentally determine the influence of the medium acidity on redox processes	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-14</i>	be able to solve situational tasks	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-15</i>	be able to perform calculations related to the preparation of buffer solutions	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-16</i>	be able to prepare buffer solutions and determine their pH value	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-17</i>	be able to select the indicator properly in the method of neutralization	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-18</i>	be able to determine the acidity of gastric juice	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-19</i>	be able to perform thermochemical calculations to evaluate the caloristry of foods	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-20</i>	be able to theoretically calculate and experimentally determine the thermal effects of chemical reactions and processes	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-21</i>	be able to explain the features of the organization of living systems and the main processes of energy conversion in them at the modern level	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-22</i>	be able to carry out precipitation reactions and dissolution of precipitates	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-23</i>	be able to use ionometers (pH meters) for potentiometric measurements	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-24</i>	be able to apply the potentiometric method for measuring the EMF of galvanic cells	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-25</i>	be able to use potentiometers (pH meters) for potentiometric purposes	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-26</i>	be able to determine the concentration of acids and bases in their solutions and mixtures with the method of potentiometric titration	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-27</i>	be able to draw conclusions about the surface activity of substances on the basis of their structure	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-28</i>	be able to analyze the peculiarities of the structure of the surface layer of adsorbed molecules of surfactants, to explain the principles of the biological membranes structure	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-29</i>	be able to analyze the adsorption equations and the limits of their application, to state distinguish between monomolecular and polymolecular adsorption	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-30</i>	be able to interpret the physicochemical properties of proteins which are structural components of all organism's tissues	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-31</i>	be able to interpret the regularitiess of adsorption of substances from solutions on a solid surface	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-32</i>	be able to distinguish selective and ion exchange adsorption of electrolytes	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-33</i>	be able to interpret methods of chromatographic analysis and their role in biomedical research	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-34</i>	be able to obtain lyophobic sols	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-35</i>	be able to experimentally determine the sign of the charge of colloidal particles of drugs with electrophoresis	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-36</i>	be able to compose formulas of micelles in the isoelectric state	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>

<i>Ab-37</i>	be able to determine experimentally the sign of the charge of colloidal particles and drugs granules	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-38</i>	be able to analyze the value of zeta potential for lyophobic sols' stability characteristics and their physiological action disclosure	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-39</i>	be able to calculate the coagulation effect of electrolytes with ions of different charges	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-40</i>	be able to establish a quantitative evaluation of the high molecular weight compounds protective effect towards the coagulation of hydrophobic sols	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-41</i>	be able to determine experimentally the high molecular weight compounds degree of swelling	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-42</i>	be able to predict the effect of electrolytes on the degree of swelling for high molecular weight compounds and biological tissues of a living organism	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>Ab-43</i>	be able to determine experimentally the isoelectric point (IET) of polyelectrolytes by their swelling and to know the influence of various factors on the swelling process	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-1</i>	the ability to solve complex problems, including research and innovation in medicine. Ability to continue studies with a high degree of autonomy	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-2</i>	the ability to abstract thinking, analysis and synthesis	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-3</i>	the ability to study and master modern knowledge	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-4</i>	the ability to apply knowledge in practical situations	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-5</i>	the ability to make informed decisions	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-6</i>	the ability to search, process and analyze information from various sources	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-7</i>	certainty and perseverance on tasks set and responsibilities assumed	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-8</i>	the ability to realize the rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-9</i>	the ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, use various types and forms of physical activity for active recreation and a healthy lifestyle	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-10</i>	the ability to determine the nature of nutrition in the treatment and prevention of diseases	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-11</i>	the ability to assess the impact of the environment, socio-economic and biological determinants on the health of the individual, family, population	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>C-12</i>	the ability to develop and implement scientific and applied projects in the field of health care	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>AR-1</i>	Management of work or learning processes that are complex, unpredictable, and require new strategic approaches	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>
<i>AR-2</i>	Responsibility for contributing to professional knowledge and practice and/or evaluating the results of team and collective activities	<i>PRS-1, PRS-2, PRS-3, PRS-5, PRS-6</i>

AR-3	Ability to continue learning with a high degree of autonomy	PRS-1, PRS-2, PRS-3, PRS-5, PRS-6
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6. Course format and scope

Discipline format (full-time or part-time)	Full-time	
Type of classes	Number of hours	Number of groups
lectures (L)	16	25
practical classes (P)	44	25
seminars	–	–
self-reliant work (SRW)	60	25

7. Topics and content of the course

Code of the class type	Topic	Scope of study	Code of the learning outcomes	Teaching staff
P-1/ L-1/SRW-1	Variables which characterizes quantitative composition of solutions. Preparation of solutions. Solutions used as disinfectants and antiseptics to prevent infection and spread of COVID-19	<p>Role of solutions in the organisms life. Classification of solutions. Mechanism of dissolution processes. Thermodynamic approach to the process of the dissolution. The solubility of the substances.</p> <p>The solubility of gases in liquids. The dependence of the solubility of gases on the pressure (Henry-Dalton's law), nature of the gas and solvent, temperature. Effect of electrolytes on the solubility of gases (Sechenov's law). Solubility of gases in the blood. Decompression sickness.</p> <p>The solubility of liquids and solids in liquids. The dependence of solubility on temperature and the nature of the solute and solvent. Nernst law of distribution and its importance in the phenomenon of the permeability of biological membranes.</p> <p>The values that characterize the quantitative composition of solutions. Preparation of solutions of a given quantitative composition.</p> <p>Solutions used as antiseptics for personal hygiene, as well as for disinfection in public and residential premises and buildings. Classification of disinfectants and antiseptics by the main active substances and their concentration in working solutions.</p>	Kn-1, Kn-2, Kn-3, Kn-4, Kn-41, Ab-1, Ab-2, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3	O. Klenina, O. Roman, M. Sulyma, I. Myrko
P-2/ L-1/ SRW-2	Colligative properties of solutions	<p>Colligative properties of diluted nonelectrolytes solutions. Lowering of the vapor pressure of the solvent above the solution. Raoult's law. Ideal solutions. Depression of the freezing point of a solution and boiling point elevation of a solution. Osmosis and osmotic pressure. Vant' Hoff's law.</p> <p>Colligative properties of diluted electrolytes solutions. Isotonic coefficient. Hypo-, hyper- and isotonic solutions.</p> <p>Cryometry, ebulliometry, osmometry, and their use in biomedical researches. The role of osmosis in biological systems. Osmotic pressure of blood plasma. Haller equation. Oncotic pressure. Plasmolysis and hemolysis.</p>	Kn-5, Ab-3, Ab-4, Ab-5, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3	
P-3/ L-2/ SRW-3	Coordination compounds formation in biological liquids	<p>Complex formation reactions. Werner coordination theory and modern understanding of the structure of complex compounds. The concept about complexing agent (central ion). Nature, coordination number, hybridization of central atom orbitals. The concept about ligands. Denticity of ligands. The inner and external spheres of the coordination compounds. Geometry of the complex ion. The nature of the chemical</p>	Kn-6 Kn-7 Ab-6, Ab-7, Ab-14, C-1, C-2, C-3,	

Code of the class type	Topic	Scope of study	Code of the learning outcomes	Teaching staff
		<p>bond in complex compounds. Classification of complex compounds according to the charge on the inner sphere and the nature of ligands. Chelate compounds. Polynuclear complexes.</p> <p>Ferro-, cobalto-, copper- and zinc- containing biocomplex compounds. Concept about metal-ligand homeostasis. Violation homeostasis. Complexons and their application in medicine as antidotes to remove toxic metal ions from the organism and as antioxidants at storage of drugs.</p>	<i>C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	
P-4/ L-2/ SRW-4	Bioelements and their classification. Chemical properties and biological role of macroelements	<p>General information about nutrients. Qualitative and quantitative content of nutrients in the body. Macronutrients, micronutrients and impurity elements. Organogens. The concept of Vernadsky's doctrine about biosphere and the role of living matter (living organisms). Relationship between the content of biogenic elements in the human body and its contents in the environment. Endemic diseases and their connection with the peculiarities of biogeochemical provinces (regions with a natural deficiency or excess of certain chemical elements in the lithosphere). Problems of biosphere pollution and purification because of toxic chemicals.</p> <p>Electronic structure and electronegativity of <i>s</i>- and <i>p</i>- elements. Typical chemical properties of <i>s</i>-, <i>p</i>- elements and their compounds (reactions without changing of oxidation state. The relationship between the location of <i>s</i>- and <i>p</i>-elements in the periodic table and their content in the body. Uses in medicine. Toxic effects of compounds.</p> <p>Reactions of identification of CO_3^{2-}, SO_4^{2-}, NO_2^-, $\text{S}_2\text{O}_3^{2-}$ ions.</p>	<i>Kn-8, Kn-9, Ab-8, Ab-9, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	
P-5/ L-2/ SRW-5	Chemical properties and biological role of microelements	<p>The metals of life. Electronic structure and electronegativity of <i>d</i>-elements. Typical chemical properties of <i>d</i>-elements and their compounds (reactions with oxidation numbers changing, complex formation reactions). Their biological significance. Uses in medicine. Toxic effects of <i>d</i>-elements and their compounds.</p> <p>Identification reactions of MnO_4^-, Fe^{3+}, Cu^{2+}, Ag^+ ions.</p>	<i>Kn-8, Kn-9, Kn-10, Kn-11, Kn-12, Ab-8, Ab-10, Ab-13, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	
P-6/ L-3/ SRW-6	Acid-base equilibrium in an organism. pH of biological liquids. Protolytical processes	<p>Electrolyte solutions. Electrolytes in the human body. The degree and the dissociation constant of weak electrolytes. Properties of solutions of strong electrolytes. Activity and activity coefficient. Ionic force of solution. Water and electrolyte balance - a necessary condition for homeostasis.</p> <p>Dissociation of water. Ionic product of water. pH. The pH values for different liquids of the human body in normal and pathological conditions.</p> <p>Theories of acids and bases. Types of protolytic reactions: neutralization, hydrolysis and ionization. Hydrolysis of salts. The degree of a hydrolysis, its dependence on concentration and temperature. Constant of a hydrolysis. The role of hydrolysis in biochemical processes.</p>	<i>Kn-13, Kn-14, Kn-15, Kn-16, Kn-17, Ab-11, Ab-12, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	
P-7/ L-3/ SRW-7	Buffer systems, their biological role	<p>Buffer solutions and their classification. Henderson-Hasselbach equation. Mechanism of buffer action.</p> <p>Buffer capacity. Buffer systems of the blood. Bicarbonate (hydrogencarbonate) buffer, phosphate buffer. Protein buffer systems. The concept of acid-base condition of blood.</p>	<i>Kn-18, Kn-19, Kn-20, Ab-15, Ab-16, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	

Code of the class type	Topic	Scope of study	Code of the learning outcomes	Teaching staff
P-8/ L-3/ SRW-8	The basic principles of the volumetric analysis	<p>Principles of titrimetric analysis. Titrimetric methods of analysis.</p> <p>The method of acid-base titration. Law equivalents and its use in quantitative analysis. Equivalence point. Acidimetry and Alkalimetry. Indicators and their application. Theory of indicators, their quantitative characteristics. Titration curves. Methods of the equivalence point determining and the calculation of the investigated substance content in the product or solution. Choice of indicators for various types of acid-base titration.</p>	<i>Kn-21, Kn-22, Kn-23, Ab-17, Ab-18, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	
P-9/ L-4/ SRW-9	The heat effects of chemical reactions in solutions. The direction of processes	<p>The special fields of chemical thermodynamics. Basic terms of chemical thermodynamics: thermodynamical system (isolated, closed, open, homogeneous, heterogeneous), the state variables (extensive and intensive), thermodynamical processes (reversible, irreversible). Living organisms as open thermodynamical systems. Irreversibility of life processes.</p> <p>The first law of thermodynamics. Enthalpy. Thermochemical equations. Standard enthalpies of formation and combustion. Hess's law. Calorimetry techniques. Biochemical processes energetic characteristics. Thermochemical calculations for the foods fuel capacity (caloricity) evaluation and making rational and therapeutic diets.</p> <p>Spontaneous and non-spontaneous processes. The second law of thermodynamics. Entropy. Thermodynamic potentials: Gibbs' free energy, Helmholtz' free energy. Thermodynamical equilibrium conditions. The criteria for the spontaneous processes direction.</p> <p>The basic principles of thermodynamics applying to living organisms. ATP as an energy source for biochemical reactions. Macroergic compounds. Energetical conjugations in living systems: exergonic and endergonic processes in the organism.</p>	<i>Kn-24 Ab-19, Ab-20, Ab-21, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-12, AR-1, AR-2, AR-3</i>	
P-10/ L-5/ SRW-10	Kinetics of biochemical reactions. The chemical equilibrium. Solubility product constant	<p>Chemical kinetics as the basis for the rates and mechanism of biochemical reactions studying. The reaction rate. Concentration affection the reaction rate. The law of mass action for the reaction rate. Rate constant. The reaction order. Kinetical equations for zero-, first- and second-order reactions. Half-life. Half-time of decomposition as quantitative characteristic of changes in the concentration in the environment of radionuclides, pesticides, etc. The reaction mechanism concept and the reaction molecularity.</p> <p>The temperature influence the reaction rate. Van't Hoff's rule. Features of the temperature coefficient of the reaction rate for the biochemical processes.</p> <p>Activation energy. Collision theory. Arrhenius equation. The concept of the transition state theory.</p> <p>The kinetics of complex reactions: parallel, successive, conjugated, reversible, chain. The concept of antioxidants. Free radical reactions in living organisms. Photochemical reactions, photosynthesis.</p> <p>Catalysis and catalysts. Features of catalysts. Homogeneous, heterogeneous and microheterogeneous catalysis. Acid-base catalysis. Autocatalysis. The mechanism of catalytical action. Promoters and catalytic poisons.</p> <p>The kinetics of enzymatic reactions. Enzymes as biological catalysts. Enzymes features: selectivity, efficiency, temperature and reaction medium affections. The concept of the enzymes action mechanism. Dependence of enzymatic processes rate on the concentration of enzyme and substrate. Activation and inhibition of enzymes. The impact of environmental factors on the kinetics of enzymatic reactions.</p> <p>Chemical equilibrium. Equilibrium constant and its expression. Chemical equilibrium shifting at change</p>	<i>Kn-15, Kn-25, Kn-26, Ab-22, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	

Code of the class type	Topic	Scope of study	Code of the learning outcomes	Teaching staff
		of temperature, pressure, concentration of substances. Le Chatelier principle. Precipitation and dissolving reactions. Solubility product constant. Precipitates formation conditions. The heterogeneous equilibrium role in general homeostasis of the organism.		
P-11/ L-6/ SRW-11, SRW-12	Measuring the electrical driving force of electrochemical elements and electrodes potentials. Measuring the redox potentials. Potentiometry determination of pH. Potentiometry titration	The electrochemical phenomena significance for biochemical processes. Electrodes potentials and their origin mechanisms. Nernst equation. The standard electrode potential. The standard hydrogen electrode. Half-cells potentials measurement. Indicator electrodes and reference electrodes. Silver-silver chloride electrode. Ion-selective electrodes. Glass electrode. Galvanic (electrochemical or voltaic) cells. Diffusion potential. Membrane potential. The biological role of diffusion and membrane potentials. Redox reactions significance for biochemical processes. Redox potential as a measure of the half-cell tendency to act as oxidizing or reducing agent. Peters' equation. A standard redox potential. The spontaneity and the direction of redox reaction proceeding prediction by their redox potentials values. Equivalent factors of reduction and oxidizing agents. Redox potentials role for the biological oxidation mechanism. Potentiometry. The technique of potentiometry determining of pH and ions activity in analyte solutions. Indicator electrodes (hydrogen, glass electrode) and their using in electrometric methods based on electromotive force (EMF) measurement of a galvanic cell. The technique of potentiometry titration. The proper choice of the indicator electrode. The integral and differential curves of potentiometry titration plotting and the equivalence point determining. The analyte solution concentration determining.	<i>Kn-27, Kn-28, Ab-23, Ab-24, Ab-25, Ab-26, Ab-14, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-12, AR-1, AR-2, AR-3</i>	
P-12/ L-7/ SRW-13	The physical chemistry of surface phenomenon. Adsorption on the mobile phases division bounders	Surface phenomena and their importance in biology and medicine. Surface tension of liquids and solutions. Isotherm of surface tension. Surfactants and surface-inactive substance. Surface activity. Duclou's-Traube rule. Adsorption at the liquid-gas and liquid-liquid interfaces. Gibb's equation. The orientation of the surfactants molecules in the surface layer. The concept of the structure of biological membranes.	<i>Kn-29, Ab-14, Ab-27, Ab-28, Ab-29, Ab-30, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-11, C-12, AR-1, AR-2, AR-3</i>	
P-13/ L-7/ SRW-14	Adsorption on the immobile surface of the phases division. Sorption of biologically active substances. The bases of the adsorption therapy. Ions-exchange adsorption. Chromatography	Adsorption at the solid-gas interface. Langmuir equation. Adsorption from solution at the solid-liquid interface. Physical sorption (or physisorption) and chemical sorption (or chemisorption). General rules for the solutes, vapours and gases adsorption. Freundlich equation. Physico-chemical basis of adsorption therapy (hemisorbtion, plazmosorbtion, limfosorbtion, enterosorption, application therapy). Immunosorbents. Adsorption of electrolytes: specific (selective) and ion exchange. Fajans-Peneth precipitation and adsorption rule. Naturally occurring ion exchangers and synthetically produced organic resins. Adsorption and ion exchange significance for the vital process in plants and living organisms. Chromatography. Chromatographic methods of analysis classification based on the phases states of matter, the technique and the separation mechanism. Adsorption, ion exchange and distribution chromatography. Chromatography applications in biology and medicine.	<i>Kn-29, Kn-30, Ab-14, Ab-31, Ab-32, Ab-33, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-11, C-12, AR-1, AR-2, AR-3</i>	

Code of the class type	Topic	Scope of study	Code of the learning outcomes	Teaching staff
P-14/ L-8/ SRW-15	Preparation, purification and properties of colloidal solutions	<p>The living organism as a disperse systems combination. Classification of disperse systems according to the aggregative state, interphase interaction, dispersion. Lyophilic and lyophobic dispersions. A structure of micelle. Structure of a double electric layer (DEL). The overall performance and history of development the ideas about DEL structure. Electrokinetical potential of a colloidal particle.</p> <p>Methods of preparation and purification of colloidal solutions. Dialysis, electro-dialysis, ultrafiltration, compensatory dialysis. Haemodialysis and “artificial kidney” device.</p> <p>Molecular-kinetic properties of dispersions. Thermal molecular motion and Brownian motion, diffusion, and osmotic pressure. Optical properties of dispersions.</p> <p>Electrokinetical phenomena. Electrophoresis. Helmholtz-Smoluchovsky’s equation. Application of electrophoresis in research, clinical and laboratory practice. Electrophoregrams.</p> <p>Disperse systems with gaseous dispersion medium. Classification of aerosols, methods of preparation and properties. The use of aerosols in clinical and sanitary practices. Toxic effect of some aerosols. Powders.</p> <p>Coarse systems with liquid dispersion medium. Suspensions, methods of preparation and properties. Pastes, their medical use.</p> <p>Emulsions, methods of preparation and properties. Types of emulsions. Emulsifiers. The use of emulsions in clinical practice. The biological role of emulsification.</p> <p>Semi colloidal soaps, detergents. Micelle formation in semi colloids solutions.</p>	<i>Kn-31, Kn-32, Kn-33, Kn-34, Kn-35, Ab-14, Ab-34, Ab-35, Ab-36, Ab-37, Ab-38, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-11, C-12, AR-1, AR-2, AR-3</i>	
P-15/ L-8/ SRW-16	Electrolytic coagulation of colloids. Properties of bio-polymers solutions	<p>Kinetic (sedimentation) and aggregative stability of disperse systems. The reasons of colloidal stability. Coagulation. The mechanism of electrolytes coagulating action. Coagulation threshold or critical concentration of coagulation. Schulze-Hardy rule. Mutual coagulation of sols. Coagulation proceedings for the potable water and wastewater purification. Colloidal protection.</p> <p>Macromolecular compounds as the basis of living organisms. Globular and fibrillar structure of proteins. Macromolecular solutions features and their similarities and differences with true and colloidal solutions.</p> <p>Swelling and dissolution of polymers. The mechanism of swelling. Swelling affecting with pH, temperature and electrolytes nature. The role of swelling in the organism physiology. Gels creation in polymers solutions. The mechanism of gels formation. The influence of pH, temperature and electrolytes presence on the gels formation rate. Thixotropy. Syneresis. Diffusion in gels. Salting out effect of biopolymers. Coacervation and phase separation and its role in biological systems.</p> <p>Anomalous viscosity of polymers solutions. The viscosity of the blood.</p> <p>Donnan membrane equilibrium.</p> <p>Isoelectric state of proteins. Isoelectric point and its determining methods. Ionic state of biopolymers in aqueous solutions.</p>	<i>Kn-36, Kn-37, Kn-38, Kn-39, Kn-40, Ab-14, Ab-39, Ab-40, Ab-41, Ab-42, Ab-43, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-11, C-12, AR-1, AR-2, AR-3</i>	

8. Verification of learning outcomes

The current control

is carried out during practical classes and aims to check the students’ assimilation of educational material.

Forms of current educational activities assessment should be standardized and include control of theoretical and practical knowledge and skills of students.

The final grade for the current educational activity is set on a 4-point (national) scale.

Learning outcome code	Code of the classes’ type	Method of learning outcomes verification	Enrollment criteria
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<p><i>Kn-1, Kn-2, Kn-3, Kn-4, Kn-5, Kn-6, Kn-7, Kn-8, Kn-9, Kn-10, Kn-11, Kn-12, Kn-13, Kn-14, Kn-15, Kn-16, Kn-17, Kn-18, Kn-19, Kn-20, Kn-21, Kn-22, Kn-23, Kn-24, Kn-25, Kn-26, Kn-27, Kn-28, Kn-29, Kn-30, Kn-31, Kn-32, Kn-33, Kn-34, Kn-35, Kn-36, Kn-37, Kn-38, Kn-39, Kn-40, Kn-41, Ab-2, Ab-6, Ab-7, Ab-8, Ab-13 Ab-15, Ab-16, Ab-19, Ab-20, Ab-21, Ab-22, Ab-37, Ab-40, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-11, C-12, AR-1, AR-2, AR-3</i></p>	<p><i>P-1, L-1, SRW-1; P-2, L-1, SRW-2; P-3, L-2, SRW-3; P-4, L-2, SRW-4; P-5, L-2, SRW-5; P-6, L-3, SRW-6; P-7, L-3, SRW-7; P-8, L-3, SRW-8; P-9, L-4, SRW-9; P-10, L-5, SRW-10; P-11, L-6, SRW-11, SRW-12; P-12, L-7, SRW-13; P-13, L-7, SRW-14; P-14, L-8, SRW-15; P-15, L-8, SRW-16</i></p>	<p>Test control is performed at each practice class according to specific objectives. Theoretical students' self-preparation control is performed in writing by answering 18 multiple choice questions in the form one-of-five, the correct answer to each is estimated at 1 point, and two numerical problems, the correct solving being estimated at 2 points. The maximum score for the entire test is 22 points.</p> <p>Each test on the topic of the relevant practical lesson includes standardized questions, knowledge of which is necessary to understand the current topic, the material of the lecture course and self-reliant work.</p>	<p>The minimum number of points required for theoretical part enrollment is 9 points (50 % of the correct answers).</p>
<p><i>Ab-1, Ab-2, Ab-3, Ab-4, Ab-5, Ab-6, Ab-7, Ab-8, Ab-9, Ab-10, Ab-11, Ab-12, Ab-13, Ab-14, Ab-15, Ab-16, Ab-17, Ab-18, Ab-19, Ab-20, Ab-21, Ab-22, Ab-24, Ab-25, Ab-26, Ab-27, Ab-28, Ab-29, Ab-30, Ab-31, Ab-32, Ab-33, Ab-34, Ab-35, Ab-36, Ab-37, Ab-38, Ab-39, Ab-40, Ab-41, Ab-42, Ab-43, Ab-44, C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-11, C-12, AR-1, AR-2, AR-3</i></p>	<p><i>P-1, L-1, SRW-1; P-2, L-1, SRW-2; P-3, L-2, SRW-3; P-4, L-2, SRW-4; P-5, L-2, SRW-5; P-6, L-3, SRW-6; P-7, L-3, SRW-7; P-8, L-3, SRW-8; P-9, L-4, SRW-9; P-10, L-5, SRW-10; P-11, L-6, SRW-11, SRW-12; P-12, L-7, SRW-13; P-13, L-7, SRW-14; P-14, L-8, SRW-15; P-15, L-8, SRW-16</i></p>	<p>The practical skills gained and the laboratory experiments carrying out assessment is performed after the laboratory work fulfilling by assessing the quality and fullness of its performance, the ability to interpret the obtained results. For the practical part of the lesson the student can get:</p> <ul style="list-style-type: none"> - 4 points, if laboratory work is completely fulfilled and the student correctly explains the experiments interpret the results and make conclusions; - 2 points, if the laboratory work is done with some errors, the student can not fully explain and summarize the obtained results; - 0 points, if the laboratory work is not performed or the student can not explain and summarize the obtained results. 	<p>The minimum number of points required for enrollment – 2.</p>
Final control			
<p>General evaluation scale</p>	<p>Participation in the current educational activity during the semester / exam – 60% / 40% on a 200-point scale</p>		
<p>Evaluation scales</p>	<p>traditional 4-point scale, multi-point (200-point) scale, ECTS rating scale</p>		
<p>Conditions of admission to the</p>	<p>The student attended all practical (laboratory, seminar) classes and gained at least 72 points for current educational activity</p>		

final control		
Exam evaluation criteria		
Exam	<p>Final control consists of the following stages:</p> <p>I stage - written answer to test questions in the multiple choice format (the answering blank with computer checking). The student meets the test package. Each package contains 66 multiple choice format tests for each thematic module, and is rated at 1 score point for each correct answer.</p> <p>II stage - written answer to 7 situational tasks (the answering blank with computer checking). Each correct answer is assessed by 2 score points. The student must provide written solutions to each situational task on the back side of the blanket (if necessary, the student can use additional sheets, certified by the stamp of the department, indicating on each sheet his name, group number and exam test-paper number). Answers to situational tasks made in the answering blank which are not supported by the necessary chemical equations of the reactions and / or calculations are not counted.</p>	<p><i>Stage I evaluation criteria:</i> The correct answer to each multiple choice format question is rated at 1 score point. The maximum number of points for stage I – 66.</p> <p><i>Stage II evaluation criteria:</i> The solution of each situational task is evaluated in 2 points for the correct answer. The maximum number of points for stage II – 14. <i>The highest possible score points which a student can get for exam is 80.</i> <i>The minimum number of point required for exam enrollment is 50.</i></p>
<p><i>The maximal number of score points which a student can gain for the current educational activity for the semester for admission to the exam is 120 points.</i> <i>The minimal number of score points which a student must gain for current educational activity for the semester for admission to the exam (differential credit) is 72 points.</i> <i>Calculation of the points number</i> is based on the grades gained by the student on a 4-point (national) scale during the study of the discipline, by calculating arithmetic mean (AM), rounded to two decimal places. The resulting value is converted into points on a multi-point scale as follows:</p> $X = \frac{AM \times 120}{5}$		
9. Course policy		
<p>When organizing the educational process for students, teaching staff and administration act in accordance with: Regulations on the organization of the educational process (https://Kutt.ly/3ySk64r); Regulations on evaluation criteria and rules (https://Kutt.ly/lySlyw0); Regulations on academic integrity (https://Kutt.ly/EyS3HHu). Academic integrity: Students' work is expected to be their original research or reasoning. Lack of references to sources used, fabrication of sources, copying, interference in the work of other student, etc. are examples of possible academic dishonesty. Identification of signs of academic dishonesty in the students' work is the basis for non-enrollment by the teacher, regardless of the extent of plagiarism or deception. Sources of training: the source base can be provided by the teacher exclusively for educational purposes without the right to transfer it to third parties. Students are encouraged to use other literature that is not listed in available syllabus.</p>		
10. Recommended literature		
<p><i>Required literature</i></p> <p>1. V.O. Kalibabchuk, V.I. Halynska, L.I. Hryshchenko Medical Chemistry, 7th edition. – AUS MEDICINE Publishing. – 2020. – 224 p.</p>		

2. V.O. Kalibabchuk, V.V. Ohurtsov, V.I. Halynska et al. General and Inorganic Chemistry (edited by V.O. Kalibabchuk) - Kyiv : AUS Medicine Publishing, 2019. - 456 c.
 3. Mandeep Dalal. A Textbook of Physical Chemistry. Volume 1. - Dalal Institute, Main Market, Sector 14, Rohtak, Haryana 124001, India. – 2019. – 404 p.
 4. Mandeep Dalal. Advanced Physical Chemistry. Volume 2. - Dalal Institute, Main Market, Sector 14, Rohtak, Haryana 124001, India. – 2020. – 500 p.
 5. Timberlake K. C. “General, organic and biological chemistry”, 6th edition. – Pearson, 2018. – 936 p.
1. Országhová Z., Žitňanová I. et al.: Textbook of Medical Chemistry. – Bratislava, 2018. – 300 p. (electronic textbook)
 2. Steven S. Zumdahl. Chemistry (4th Edition). – Houghton Mifflin Company. – 1997. – 1031 p.

Additional literature

1. John McMurry, Robert C. Fay. Chemistry (3rd Edition). – Prentice Hall. – 2001. – 1067 p.
2. David E. Goldberg. Fundamentals of Chemistry (2nd Edition). – WCB/McGraw-Hill. – 1998. – 561 p.
3. Theodore L. Brown, H.Eugene LeMay, Bruce E. Bursten. Chemistry. The Central Science. – Prentice Hall. – 2000. – 1017 p.
4. John Olmsted III, Gregory M. Williams. Chemistry. The Molecular Science. – Mosby. – 1994. – 977 p.

11. Equipment, logistics and software of the discipline

The department is provided with premises for lectures and practical classes and control activities on the discipline in small groups. Lecture halls are equipped with multimedia equipment. For laboratory works fulfilment and practical skills working off academic and research laboratories are used which are equipped with the necessary chemical ware, reagents and instruments.

Lecture presentations, guidelines for practical and self-reliant work are posted on the distance learning service MISA and are available for students.

12. Additional information

The person responsible for the educational process at the department – Marta Sulyma, PhD in Pharmacy, executor of Assoc.Prof. duties, e-mail: sumarta145@gmail.com

The Department has a student research group, focused on the synthesis of novel biologically active substances and analysis of newly synthesized compounds and drugs.

Students should wear medical gowns and hats during lectures and practical classes.

Classes are held in the premises of the department at the addresses: Pekarska Str., 52, Lviv, Chemistry building; 3a Shimzeriv Str, Lviv, Theoretical building.

Department website: <https://new.meduniv.lviv.ua/kafedry/kafedra-zagalnoyi-bioneorganichnoyi-fizkoloyidnoyi-himiyi/>

Syllabus complier

Olena Klenina, PhD in Pharmacy, Assoc. Prof.



The Head of the department

Iryna Drapak, Doctor of Sciences in Pharmacy, Professor

