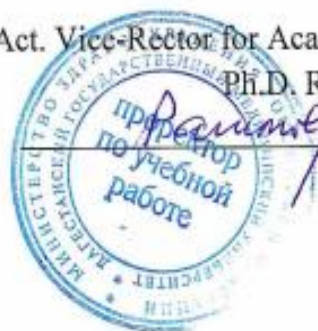


FEDERAL STATE BUDGET EDUCATIONAL
INSTITUTION OF HIGHER EDUCATION
«DAGESTAN STATE MEDICAL UNIVERSITY»
MINISTRIES OF HEALTH OF THE RUSSIAN FEDERATION
(FGBOU VO DSMU of the Ministry of Health of Russia)

AGREED

Act. Vice-Rector for Academic Affairs,
Ph.D. R. M. Ragimov



31/05/2023

WORKING PROGRAM OF THE DISCIPLINE
"CHEMISTRY"

Index of discipline according to the curriculum: Б 1. 0. 11

Specialty: 31.05.01 General Medicine

Level of higher education: specialist

Graduate Qualification: Medical Doctor

Faculty: medical

Department of General and Biological Chemistry

Full-time form of education

Course: 1

Semester: II

Total labor intensity: 2 c.u. / 72 hours

Lectures: 32 hours

Practical training: 34 hours




Independent work of the student: 6 hours

Form of control: credit in the II semester

The work program of the discipline was developed in accordance with the Federal State Educational Standard 3 ++ VO in the direction of training (specialty) 31.05.01 General Medicine (level of higher education - specialist), approved by order of the Ministry of Education and Science of the Russian Federation No. 988 of August 12 2020

The work program of the academic discipline was approved at a meeting of the Department of General and Biological Chemistry on 23/05/ 2023, Protocol No. 9.

Work program agreed:

1. Director of NMB DSMU _____  _____ (V.R. Musaeva)
2. UUMR, S and KKO _____  _____ (A.M. Karimova)
3. Dean of the Faculty of Medicine _____  _____ (R.T. Savzikhanov)

Head of the department, MD, prof. _____  _____ (E.R. Nagiev)

Work program developer

Ph.D., Assoc. _____  _____ (U.G. Gamzaeva)

1. PURPOSE AND OBJECTIVES OF MASTERING THE DISCIPLINE

The discipline "Chemistry" refers to the mandatory part of the curriculum of the educational program in the specialty 31.05.01 General Medicine

The purpose of mastering the discipline "Chemistry" is the formation of the ability to assess the morpho-functional, physiological states and pathological processes in the human body to solve professional problems.

Objectives of the discipline: to form basic knowledge about the physical and chemical nature, mechanisms and patterns of processes occurring in a living organism, about the basics of modern chemical and physical and chemical methods used in medical science and practice.

II. PLANNED TRAINING OUTCOMES IN THE DISCIPLINE

Code and name of competence (or parts of it)	Code and name of the indicator of achievement of competence
ОПК-5 Able to assess morphofunctional, physiological conditions and pathological processes in the human body to solve professional problems.	ИД-1_{ОПК-5} Able to evaluate morpho-functional processes under physiological conditions. ИД-2_{ОПК-5} Able to evaluate functional processes in pathological conditions.
As a result of mastering the discipline, the student must	
Know: <ul style="list-style-type: none">- physical and chemical aspects of the most important biochemical processes and various types of homeostasis in the body: the theoretical foundations of bioenergetics, factors affecting the shift in the balance of biochemical processes;- Fundamentals of chemistry of biogenic elements, their role in the life of the organism;- the essence of the metal-ligand balance in the body and the causes of its violation.- physical and chemical foundations of surface phenomena, dispersed systems, macromolecular compounds, their essence, role in metabolism, basic principles of their use in medicine;- the chemical nature, structure and functions of biologically important organic compounds (nucleic acids, natural proteins, carbohydrates, fats, water-soluble and fat-soluble vitamins, hormones, etc.) in ensuring the normal functioning of a healthy human body, in the formation of basic physiological indicators that contribute to the preservation and health promotion, prevention of diseases and viral infections: SARS, influenza, COVID - 19.	
Be able to: <ul style="list-style-type: none">- to interpret the data of the main physical-chemical, mathematical and natural-science research methods in solving professional problems;- predict the direction, completeness and results of chemical and physico-chemical processes, based on the theoretical positions of chemistry, the results of calculations and observations;- explain the causes and consequences of changes in the direction, completeness and results of chemical and physico-chemical processes occurring in the human body;- to make physical and chemical measurements that characterize certain properties of solutions, mixtures and drugs;-classify chemical compounds based on their structural formulas; predict the behavior and functions of organic substances in a living organism based on their classification (structure and presence of functional groups); analyze the effect of certain drugs on the basis of the classification of its functional group and structure;- to observe the course of chemical reactions and draw reasonable conclusions;- predict the course of reactions of different types, taking into account their competitive nature;- scientifically substantiate the results obtained, solve typical practical problems and master the theoretical minimum at a more abstract level;- present the results of experiments and observations in the form of graphs and tables;- carry out statistical processing of the obtained results..	
Own: <ul style="list-style-type: none">- terminology and the technique of conducting qualitative reactions to some biologically important compounds and drugs;- ideas about the main chemical and physico-chemical research methods and technologies used in medicine; skills in analysis and calculation of the parameters of the most important chemical and physico-chemical processes;- basic skills of obtaining and processing data of a chemical experiment, their use in medical practice; calculations of the composition and preparation of solutions.	

III. THE PLACE OF THE EDUCATIONAL DISCIPLINE IN THE STRUCTURE OF THE EDUCATIONAL PROGRAM

The academic discipline "Chemistry" is included in the basic part of the working curriculum for training in the specialty 31. 05. 01 General Medicine with the index Б1.0.11.

In accordance with the current curriculum, this discipline is studied in the second semester.

The material of the discipline is based on previously acquired knowledge in biology, mathematics, physics. The discipline "Chemistry" is fundamental for the study of the following disciplines: biological chemistry, normal and pathophysiology, pharmacology, toxicological chemistry, hygiene, internal medicine and physiotherapy.

The development of competencies in the process of studying the discipline contributes to the formation of knowledge, skills and abilities that allow for effective work on the implementation of the following types of tasks of professional activity: therapeutic and research.

IV. VOLUME OF DISCIPLINE AND TYPES OF TRAINING

The total complexity of the discipline is 2 credit units.

Types of work		Number of hours per semester
Contact work (total), including:		66
Classroom work		54
Lectures (L)		32
Practical class (PC)		34
Independent work of the student (IWS)		6
Type of intermediate certification		credit
TOTAL: Total labor intensity	a.h.	72
	z.e.	2

V. CONTENT OF THE EDUCATIONAL DISCIPLINE

5.1. Sections of the discipline and competencies that are formed during their study

№ п/п	Controlled competencies	Name of the section of the discipline	Section content
1	2	3	4

1.	ОПК-5 ИД-1 _{ОПК-5} ИД-2 _{ОПК-5}	General chemistry. Biologically active low molecular weight inorganic substances. Thermodynamics	Chemistry of biogenic elements The concept of the biogenicity of chemical elements. Macro- and microelements. Biosphere. Cycle of biogenic elements. Cumulation of biogenic elements by living systems. Classification of elements according to their functional role in the body. Ecological aspects of the chemistry of biogenic elements. Electronic structures of atoms and cations. The most important biogenic elements of the d-block are biometals: chromium-copper, molybdenum. Redox properties: patterns of stability of oxidation states, disproportionation of intermediate oxidation states. Stability in the conditions of the organism of the degree of oxidation. Complex compounds of d-elements. Classification of complexes according to the charge and nature of ligands. Werner coordination theory. Nomenclature of complex compounds. Fundamentals of ligand-exchange equilibria and processes. Ionic equilibrium in solutions of complex compounds. Non-strength constants. The role of complex compounds in the vital activity of the organism. Their application in therapy, ecology. Brief comparative characteristics and medical and biological significance of the compounds of iron, molybdenum, tungsten, cobalt, nickel, copper, silver, zinc, mercury. Theoretical foundations of thermodynamics and bioenergetics. The concept of a thermodynamic system. First law of thermodynamics. Enthalpy. Hess' law. Application of the first law of thermodynamics to biosystems. Entropy. Gibbs energy. Forecasting the direction of spontaneous processes The principle of energy conjugation.
2.	ОПК-5 ИД-1 _{ОПК-5} ИД-2 _{ОПК-5}	The main types of chemical equilibria and processes in the functioning of living systems.	The doctrine of solutions. The role of water in life. Colligative properties of solutions. Raoult's law. Osmosis and osmotic pressure: van't Hoff's law. The concept of isosmia. The role of osmosis in biological systems. Plasmolysis, hemolysis. Protolytic equilibria and processes. Protolytic theory of acids and bases. dissociation of water. Formation of hydrogen bonds as a factor of self-organization of living systems. pH-hydrogen indicator. Buffer solutions and buffer systems. The theory of acid-base balance as a basis for learning the patterns of functioning of the protolytic buffer systems of blood, lymph and other biological fluids. Heterogeneous equilibria and processes in the body. Conditions for the formation and dissolution of precipitates. Solubility constant and solubility. The phenomenon of isomorphism
3.	ОПК-5 ИД-1 _{ОПК-5} ИД-2 _{ОПК-5}	Physical chemistry of surface phenomena in the functioning of living systems.	Physical chemistry of surface phenomena and properties of disperse systems Gibbs surface energy. Adsorption. Gibbs equation. Surface-active and surface-inactive substances. Orientation of molecules in the surface layer and the structure of biomembranes. The structure of a micelle. Adsorption equilibria and processes at fixed and moving phase boundaries. Langmuir equation. Adsorption phenomena in biology and medicine. Disperse systems Classification of dispersed systems. Micellization in Surfactant Solutions. Preparation, properties and purification of colloid solutions. Principles of stability of colloidal solutions. Coagulation phenomena.

4.	ОПК-5 ИД-1 _{ОПК-5} ИД-2 _{ОПК-5}	Bioorganic chemistry. Poly- and heterofunctional compounds involved in the processes of vital activity.	Specific reactivity of polyfunctional and heterofunctional organic compounds. Optical isomerism of hydroxy acids. Racemic mixtures. Reactions of cyclization and elimination of hydroxy acids. Dibasic and tribasic hydroxy acids. Their importance in biology and medicine. Salicylic acid and its derivatives. The presence of an α -CH-acid center in oxo compounds as a reason for the formation of a C-C bond in vivo reactions.
5.	ОПК-5 ИД-1 _{ОПК-5} ИД-2 _{ОПК-5}	Biopolymers and their structural components.	Biologically important heterocyclic compounds. α -Amino acids, peptides, proteins. Qualitative reactions to α -amino acids. Carbohydrates (mono-, di- and polysaccharides). Nucleic acids, nucleotide coenzymes.

5.2. Sections of the discipline and labor intensity by types of educational work

№ section	Name of the discipline section	Types of educational work, hour.			Total
		Classroom		Extracurricular	
		L	PC	IWS	
1	General chemistry. Biologically active low molecular weight inorganic substances. Thermodynamics	4	6	1	11
2	The main types of chemical equilibria and processes in the functioning of living systems.	6	6	1	13
3	Physical chemistry of surface phenomena in the functioning of living systems	4	4	1	9
4	Bioorganic chemistry. Poly- and heterofunctional compounds involved in the processes of vital activity.	6	6	1	13
5	Biopolymers and their structural components.	12	12	2	26
Type of intermediate certification		Debit			
Total for the semester:		32	34	6	72

5.3. Thematic plan of lectures

№ section	Section name	Lecture Topics	Number of hours per semester
1	General chemistry. Biologically active low molecular weight inorganic substances. Thermodynamics	L1. Chemistry of biogenic elements. Complex compounds.	2
		L2. Chemical thermodynamics	2

2	The main types of chemical equilibria and processes in the functioning of living systems.	L3. Solutions. Colligative properties of solutions.	2
		L4. Buffer systems.	2
		L5. Heterogeneous phenomena and processes	2
3	Physical chemistry of surface phenomena in the functioning of living systems	L6. Physical chemistry of surface phenomena. Adsorption.	2
		L7. Physical chemistry of dispersed systems. Colloidal solutions.	2
4	Bioorganic chemistry. Poly- and hetero-functional compounds involved in the processes of vital activity.	L8. Bioorganic chemistry. Poly - and heterofunctional organic compounds.	4
		L9. Biologically important heterocyclic compounds.	2
5	Biopolymers and their structural components.	L10. Saponifiable lipids.	2
		L11. Amino acids. Proteins and peptides	4
		L12. Carbohydrates. Mono-, di- and polysaccharides.	4
		L13. Nucleic acids.	2
		Total:	32

5.4. Practical class

№ п/п	Section of discipline	Name of practical classes	Forms of current control	Number of hours per semester
1	General chemistry. Biologically active low molecular weight inorganic substances.	PC.1. Biogenic elements. Complex compounds	C, Pr	2
		PC.2. Chemical thermodynamics	C, PC,	2
		PC. 3. Determination of the thermal effect of a chemical reaction.	Pr , T	2
2	The main types of chemical equilibria and processes in the functioning of living systems.	PC 4. Solutions. Colligative properties of solutions.	C, T, Pr	2
		PC.5. Buffer systems. Buffer capacity.	C, Pr, SZ, T	2
		PC.6. Heterogeneous processes and equilibrium.	T, C, PC	2
3	Physical chemistry of surface phenomena in the functioning of living systems.	PC.7. Surface phenomena.	C , P, Pr, RZ	2
		PC.8. Disperse systems. Colloidal solutions. Stability of colloidal systems. Coagulation.	C, T, Kr	2

4	Bioorganic chemistry. Poly- and hetero-functional compounds involved in the processes of vital activity.	PC.9. Poly- and heterofunctional compounds.	Pr. T.,C.	2
		PC.10. Nitrogen-containing biologically important heterocyclic compounds.	C, T	2
		PC.11. Saponifiable lipids.	C, T, Pr.	2
5	Biopolymers and their structural components.	PC.12. α -amino acids.	C. Pr	2
		PC.13. Proteins and peptides.	C. T.	2
		PC.14. Carbohydrates. Monosaccharides.	C.	2
		PC.15. Di- and polysaccharides.	C. T.	2
		PC.16. Nucleic acids	C. T.	2
		PC.17. Frontier control. Debit.	Koll.	2
ИТОГО:				34

Forms of current progress control (with abbreviations): T - testing, Pr - assessment of the development of practical skills, P - writing and defending an essay, C - interview on control questions, Kolloquium, Kr - control work, SZ-situational tasks, RZ-calculation tasks.

5.5. Educational and methodological support for independent work in the discipline

5.5.1. Independent work of the student in the discipline

№	Chapter disciplines	Types of IWS	Total hours	Form of control
1	General chemistry. Biologically active low molecular weight inorganic substances. Thermodynamics	Abstract messages with the preparation of multimedia presentations Preparation for control work, testing, laboratory work.	1	C
2	The main types of chemical equilibria and processes in the functioning of living systems.	Calculation tasks. Abstract messages with the preparation of multimedia presentations. Preparation for control and laboratory work.	1	Pr C
3	Physical chemistry of surface phenomena in the functioning of living systems	Abstract messages with the preparation of multimedia presentations Preparation for testing, colloquium, laboratory work. Work with electronic educational resources placed in the electronic information system of the DSMU.	1	T Pr C

4	Bioorganic chemistry. Poly- and hetero-functional compounds involved in the processes of vital activity.	Abstract messages on the instructions of the teacher with the preparation of multimedia presentations. Work with electronic educational resources placed in the electronic information system of the DSMU. Preparation for testing, preparation for colloquium, laboratory work.	1	C Pr T Kr
5	Biopolymers and their structural components.	Abstract messages with the preparation of multimedia presentations. Preparation for control work, laboratory work. Preparation for practical tasks. Preparation for the current test control. Performance of extra-curricular tasks - abstract.	2	Kr P C Pr
Total			6	

* The form of intermediate certification is a test. Forms of current progress control (with abbreviations): T - testing, Pr - assessment of the development of practical skills, P - writing and defending an essay, C - interview on control questions, Coll - Colloquium, Kr - control work, SZ - situational tasks, ST - settlement tasks, FC - frontier control.

5.5.2. Topics of essays on independent work of students:

1 SECTION 1. (ID-1 OPK-5, ID-2OPK-5)

1. Medico-biological role of s-block elements.
2. Biomedical role of p-block elements.
3. Biomedical role of d-block elements.
4. What metals do ligands choose for themselves? (General acquaintance with Pearson's concept).
5. Structure and properties of oxygen carrier complexes

SECTION 2. (ID-1 OIK-5, ID-2 OIK-5)

1. Living organism and thermodynamics.
2. Calorie content of foodstuffs, the principles of making diets for the diet.
3. Activation energy.
4. Thermodynamic aspect of chemical equilibrium.
5. The direction of the flow of chemical reactions.

SECTION 3. (ID-1 OIK-5, ID-2 OIK-5)

1. Water is a universal solvent. Anomalies in the physical properties of water.
2. Medico-biological significance of osmosis and osmotic pressure.
3. Physical and chemical bases of water-electronic balance in the body.
4. Acidosis, alkalosis.
5. R-basic balance and alkaline reserve of blood.
6. Composition and concentration of components of physiological solutions.
7. Micelle formation. The phenomenon of solubilization in medicine and pharmacy.
8. The phenomena of coagulation, colloidal protection and peptization in a living organism.

SECTION 4. (ID-1 OIK-5, ID-2OIK-5)

1. Optical isomerism of hydroxy acids. Racemic mixtures.
2. Reactions of cyclization and elimination of hydroxy acids.
3. Dibasic and tribasic hydroxy acids. Their importance in biology and medicine.
4. Salicylic acid and its derivatives.
5. The presence of an α -CH-acid center in oxo compounds as a reason for the formation of a C-C bond in in vivo reactions.

SECTION 5. (ID-1 ОПК-5, ID-2 ОПК-5)

1. Heteropolysaccharides. Hyaluronic acid.
2. Heteropolysaccharides. Chondroitin sulfates
3. Heteropolysaccharides. Heparin.
4. The role of hydrogen bonds as a factor in the self-organization of living systems. Formation of hydrogen bonds between DNA and RNA structures.
5. The principle of complementarity. How it works?

VI. EVALUATION TOOLS FOR CURRENT CONTROL OF PERFORMANCE AND INTERIM CERTIFICATION ON THE RESULTS OF MASTERING THE DISCIPLINE

The fund of assessment tools in a complete set, for the current monitoring of academic performance and intermediate certification based on the results of mastering the discipline, was developed in the form of an independent document in the form of an appendix to the work program of the discipline. (Attachment 1)

6.1. List of competencies indicating the stages of their formation in the process of mastering the work program of the discipline

Controlled Competency Code	Name of the discipline section	Forms of control
ИД-1 ОПК-5 ИД-2 ОПК-5	General chemistry. Biologically active low molecular weight inorganic substances. Thermodynamics	P, T, PC
ИД-1 ОПК-5 ИД-2 ОПК-5	The main types of chemical equilibria and processes in the functioning of living systems.	C, P, Pr,
ИД-1 ОПК-5 ИД-2 ОПК-5	Physical chemistry of surface phenomena in the functioning of living systems	P, C, Pr, Koll, C3, P3, T.
ИД-1 ОПК-5 ИД-2 ОПК-5	Bioorganic chemistry. Poly- and hetero-functional compounds involved in the processes of vital activity.	C, P, Pr, T, Kr.
ИД-1 ОПК-5 ИД-2 ОПК-5	Biopolymers and their structural components.	C, P, Pr, Kr

6.1.2. Evaluation tools for monitoring progress

For the current control of the progress of the discipline, the following evaluative means are used:
1) Typical tasks for evaluating the results of mastering competence at the “Know” level (the basics of the chemistry of biogenic elements, their role in the life of the body; the essence of the metal-ligand balance in the body and the reasons for its violation.):

TESTING

SECTION 1. BIOLOGICALLY ACTIVE LOW MOLECULAR WEIGHT INORGANIC SUBSTANCES.

PZ.1. BIOGENIC ELEMENTS. COMPLEX COMPOUNDS

CONTROLLED COMPETENCE CODE ОПК-5 ИД-2

Biogenic elements

1. Endemic diseases are associated: with human growth
!with peculiarities of organisms !with sleep and rest regimen
!+with the biogeochemical state of the habitat !with the weight of a person
2. The presence in the body of a constant admixture of strontium ions, along with calcium ions, is ex-

plained by: the difference in the sizes of their ions
 !+ the similarity of the sizes of their ions! the difference in the structure of their atoms

3. Biogenic elements include: contained in food
 !+Necessary for the life of the body
 !getting into the body from the environment
 !getting into the body from the internal environment

4. In all compounds contained in living organisms, hydrogen has an oxidation state: +1 0 -1

5. Sodium and lithium accumulate:
 !in the intracellular fluid !+in the extracellular fluid

6. Potassium, rubidium and cesium accumulate in the body:
 !+in the intracellular fluid !in the extracellular fluid

7. In the body, sodium is in the form of salts: chlorides phosphates
 hydrocarbonates !+all the above compounds

8. Constant excessive consumption of NaCl contributes to the appearance in the body of osmotic: !+hypertension !hypotension !isoosmia

9. Hypertonic solutions of NaCl have the following properties: ! analgesic ! + antimicrobial ! anti-spasmodic
 !regulation of osmotic homeostasis

10. The use of NaHCO₃ in large doses leads to:
 !+alkalosis !increased acidity of gastric juice
 !acidosis !lower. acidity of gastric juice

Criteria for assessing the current control of progress (testing):

- "Excellent": 100-90%
- "Good": 89-70%
- "Satisfactory": 69-51%
- "Unsatisfactory": <50%

2) Typical tasks for evaluating the results of mastering the competence at the level of "To be able" (to interpret the data of the main physical-chemical, mathematical and natural scientific methods of research in solving professional problems): SUMMARY

Section 1.4 Physical chemistry of surface phenomena in the functioning of living systems.
 Controlled competency code ОПК-5 (ИД-2 ОПК-5)

1. The use of surfactants in surgery. The structure of the surfactant. Mechanism of action.
2. Adsorption. Types of adsorption therapy.

Criteria for evaluating current control (abstract):

- Novelty of the abstracted text: max. – 20 points;
- The degree of disclosure of the essence of the problem: max. – 30 points;
- Validity of the choice of sources: max. – 20 points;
- Compliance with design requirements: max. – 15 points;
- Literacy: max. - 15 points.

Abstract evaluation:

The abstract is evaluated on a 100-point scale, the points are converted into academic performance assessments as follows (points are taken into account in the process of the current assessment of knowledge of the program material):

- 86 - 100 points - "excellent";
- 70 - 75 points - "good";
- 51 - 69 points - "satisfactory";

- less than 51 points - "unsatisfactory".

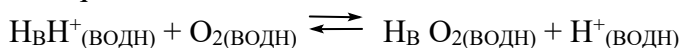
SITUATIONAL AND CALCULATION PROBLEMS

SECTION 2. MAIN TYPES OF CHEMICAL EQUILIBRIA AND PROCESSES IN THE FUNCTIONING OF LIVING SYSTEMS.

PC №. 6. COLLIGATIVE PROPERTIES OF SOLUTIONS.

CONTROLLED COMPETENCY CODE ОПК-5 ИД-2.

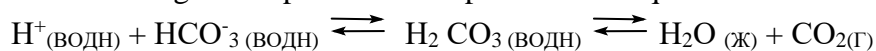
1. Acidosis or alkalosis disrupts the mechanisms of oxygen transfer by hemoglobin in the blood. Hemoglobin is involved in several equilibria, the overall result of which can be roughly described by the equation:



In which direction does this equilibrium shift in acidosis?

Explain why this leads to oxygen starvation.

2. The concentration of H^+ (VOD) ions changes as a result of a change in the rate of removal of CO_2 from the lungs. This process corresponds to the equilibrium:



Explain why an increase in CO_2 concentration causes acidosis?

3. The patient delivered to the clinic has a blood pH of 7.49. Alkaline reserves are increased; CO_2 pressure is reduced. What type of COS is observed in the patient?

- metabolic uncompensated acidosis
- gas uncompensated alkalosis
- gas compensated alkalosis
- metabolic compensated alkalosis.

Criteria for assessing the current control of progress (Situational and calculation tasks):

- ✓ "Fine":
- ✓ The answer to the question is correct. The explanation of the course of its solution is detailed, consistent, competent, with theoretical justifications (including from the lecture course), with the necessary schematic images, answers to additional questions are clear and precise.
- ✓ Good:
- ✓ The answer to the question is correct. The explanation of the course of its solution is detailed, but not logical enough, with single errors in details, some difficulties in theoretical justification (including from lecture material), in schematic images, and answers to additional questions are correct, but not clear enough.
- ✓ "Satisfactory":
- ✓ The answer to the question is correct. The explanation of the course of its solution is insufficiently complete, inconsistent, with errors, weak theoretical justification (including lecture material), with significant difficulties and errors in schematic images, answers to additional questions are not clear enough, with errors in details.
- ✓ "Unsatisfactory":
- ✓ The answer to the question was given incorrectly. The explanation of the course of its decision is given incomplete, inconsistent, with gross errors, without theoretical justification (including lecture material); answers to additional questions are incorrect (missing).

TEST PAPERS

Examination No. 2

Section 1.2: Elements of chemical thermodynamics, thermodynamics of solutions and chemical kinetics

PC No. 2. Thermodynamics.

Controlled competency code ОПК-5 (ИД-1_{ОПК-5}).

Ticket number 1

1. Chemical thermodynamics as a theoretical basis for bioenergetics.
2. Calculate the enthalpy change under standard reaction conditions $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) = 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$ if the standard enthalpies of formation of the substances involved in the reaction are: - 46 kJ / mol (NH₃); 91 kJ/mol (NO); - 286 kJ/mol (H₂O).
3. Based on Hess's law, calculate the student's energy costs per day, if he consumes per day: 8 g of protein, 80 g of fat, 400 g of carbohydrates. When burning 1 g of protein, fat, carbohydrates, 4.2 is released; 9.5; 4.3 kJ, respectively.

Criteria for assessing the current control of progress (Test work):

"Fine":

The student has a deep knowledge of the educational material on the topic of the practical lesson "Thermodynamics". Formulated and presented a complete and correct answer to a theoretical question in compliance with the logic of the presentation of the material. Correctly solved and designed the proposed tasks.

"Good":

The student showed knowledge of the educational material, mastered the basic literature. Demonstrates knowledge of theoretical and practical material on a given topic in writing, allowing minor inaccuracies in answering a theoretical question or formulating an answer to the proposed tasks.

"Satisfactorily":

The student as a whole has mastered the material of the practical lesson, but finds it difficult to correctly assess the proposed task, gives an incomplete answer to the proposed theoretical question.

"Unsatisfactory":

The student has significant gaps in the knowledge of the main educational material of the practical lesson, did not fully disclose the content of the question, gives an incorrect assessment of the situation in the proposed tasks, and does not solve them correctly. An unsatisfactory mark is given to a student who refuses to answer the ticket questions in writing.

INTERVIEW ON CONTROL QUESTIONS

Section 5.: Biopolymers and their structural components.

PC.17. Nucleic acids

Controlled competency code ОПК-5 (ИД-1_{ОПК-5}).

1. Pyrimidine and purine nucleic bases and their abbreviations.
1. Structure of nucleosides.
3. The structure of nucleotides and their names as phosphates.
4. The principle of the structure of the polynucleotide chain (the primary structure of DNA and RNA).
3. Complementarity of nucleic bases as a reason for the stabilization of the DNA double helix.
4. Polynucleoside phosphates and their participation in biochemical processes of transfer of phosphate groups.
5. The structure of nicotinamide coenzymes - NAD⁺ and NADP⁺ (oxidized forms) and NADH and its phosphate NADPH (reduced forms).
6. Hydride ion transfer as a chemical basis for the redox action of the NAD⁺/NADH system.

Criteria for assessing the current control of progress

(Interview on control questions):

✓ Excellent

The student has a deep knowledge of the educational material on the topic of this lesson, formulated a complete and correct answer to the questions of the topic of the lesson, in compliance with the logic of presentation of the material, shows the assimilation of the relationship of basic concepts and terms, was able to answer all clarifying and additional questions. The student demonstrates knowledge of theoretical and practical material on the topic of the lesson.

✓ Good

The student showed knowledge of the educational material, mastered the basic literature, was able to answer almost completely all the additional and clarifying questions asked. The student demonstrates knowledge of theoretical and practical material on the topic of the lesson, allowing minor inaccuracies.

✓ Satisfactory

The student as a whole mastered the material of the practical lesson, answered not all clarifying and additional questions. The student finds it difficult to correctly assess the proposed question, gives an incomplete answer, requiring leading questions from the teacher.

✓ Unsatisfactory

The student has significant gaps in the knowledge of the main educational material of the practical lesson, did not fully disclose the content of the questions, could not answer clarifying and additional questions. The student gives an incorrect assessment of the situation, incorrectly chooses an algorithm of actions. An unsatisfactory mark is given to a student who refuses to answer questions on the topic of the practical lesson.

3) Typical tasks for evaluating the results of the formation of competence at the level of "To master" (to solve complicated problems based on the acquired knowledge, skills and abilities, with their application in atypical situations, is formed in the process of practical activity):

COLLOQUIUM

Section 2. PZ.9 Colligative properties of solutions. Acid-base balance. Salt hydrolysis. Buffer systems

Controlled competency code ОПК-5 (ИД-1-ОПК-5, ИД-2-ОПК-5)

Control questions and tasks

Colligative properties of solutions.

1. Solutions, their classification.
2. Methods for expressing the concentration of solutions (mass fraction, molar concentration, molar concentration of the equivalent, molar concentration).
3. Colligative properties of solutions.
4. Raoult's law and consequences from it.
5. Ebullioscopic and cryoscopic constants. Methods of ebullioscopy and cryoscopy.
6. Osmosis and osmotic pressure. The role of osmosis and osmotic pressure in biological systems.
7. Van't Hoff's law for non-electrolytes and electrolytes. Isotonic coefficient, its physical meaning.
8. Hypo-, hyper-, isotonic solutions. Solutions are isotonic blood.
9. The phenomenon of plasmolysis, hemolysis and isoosmia.

Tasks

1. 0.5 mol of urea was dissolved in 300 g of water. Find the decrease in pressure of saturated water vapor over the solution at 100°C ($p_0=101.3$ kPa).
2. 1 mol of fructose was dissolved in 720 g of water. Find the pressure drop of the solvent vapor over the solution at 100 °C ($p_0 = 101.3$ kPa).
3. Dissolved 6 g of urea with $M_r(\text{CO}(\text{NH}_2)_2) = 60$ g/mol in 180 g of water. Find the vapor pressure of the solvent over a solution of urea at 100 ° C ($p_0 = 101.3$ kPa).
4. Find the boiling point of a 0.1 mol/kg NaCl solution ($i = 1.92$), and $K_{eb} = 0.563$.
5. Calculate at what temperature a solution containing 250 g of glucose in 1 liter of water should crystallize ($K_{cr} = 1.86$).
6. When dissolving 5 g of a substance in 200 g of water, a solution is obtained that crystallizes at -1.45 ° C. Determine the molecular weight of the substances. ($K_{cr} = 1.86$).

Situational tasks

1. Under pathological conditions, various types of edema can occur in the body: congestive edema (with mechanical damage), cardiac edema, edema with hypoproteinemia (decrease in blood concentration), etc.

a) Explain the mechanism of the occurrence of congestive edema using the scheme of physico-chemical regulation of water-salt metabolism.

b) What are the physical and chemical bases for the occurrence of cardiac edema, edema in hypoproteinemia?

c) What types of edema do you know?

2. A great danger to the life of the patient is edema of the brain, lungs, in which one of the ways to provide assistance is the introduction of hypertonic solutions of glucose.

a) Why is hypertonic glucose solution administered to a patient in case of life-threatening edema of the brain and lungs?

b) What advantages do glucose solutions have over sodium solutions?

c) Why is the use of salts in case of edema unacceptable?

Criteria for assessing the current control of progress (Colloquium):

✓ "Unsatisfactory":

Knowledge: The student is not able to independently identify the main provisions in the studied material discipline. Does not know and does not understand a significant or basic part of the program material within the limits of the question posed.

Skills: The student does not know how to apply incomplete knowledge to solving specific issues and proposed situational tasks.

Skills: The student does not have practical skills for solving problems in this section.

✓ "Satisfactory"

Knowledge: The student has mastered the main content of the discipline, but has gaps in the assimilation of the material, which do not prevent the further assimilation of the educational material in the discipline "Chemistry". Has unsystematized knowledge of the previous sections. The material is presented fragmentarily, inconsistently.

Skills: The student inconsistently and not systematized is able to use incomplete knowledge of the material, finds it difficult to apply the knowledge necessary to solve the problems of this section when explaining specific concepts and laws.

Skills: The student makes mistakes and inaccuracies in calculations, the use of terminology.

✓ "Good":

Knowledge: The student is able to independently identify the main provisions in the studied material. Show knowledge of this section. Gives a complete and correct answer to the question posed, but allows minor errors and inaccuracies when reproducing terms and formulas, allows inaccuracies in solving problems that do not distort their essence.

Skills: Be able to independently highlight the main provisions in the material being studied, give examples that confirm their importance in biology and medicine, draw conclusions

Able to use the acquired knowledge in practice, owns scientific terminology. The student owns the material of this section of the discipline, presents it consistently, allowing for minor errors and inaccuracies, does not have accurate skills in working with reference literature, is oriented correctly, but works slowly.

✓ "Fine":

Knowledge: The student independently identifies the main provisions in the section under study and is able to briefly and correctly characterize the basic laws and phenomena.

Skills: The student is able to compose a complete and correct answer based on the studied material, highlight the main thing, confirm the answer with various examples, independently and reasonably make an analysis, generalizations and conclusions.

Skills: The student shows complete mastery of the entire volume of the material in this section, has the skills to solve problems.

TESTING PRACTICAL SKILLS

Section 5. Biopolymers and their structural components.

Controlled competency code (ОПК-5(ИД-1_{ОПК-5})

PC.13. α -amino acids. Proteins and peptides.

Practical tasks.

1. Write projection formulas and indicate their belonging to stereochemical series for:
a) alanine; b) phenylalanine; c) valine.
2. Write the dissociation equations for leucine and aspartic acid.
3. Show amphoteric properties using reaction equations:
a) alanine; b) aminoacetic acid; c) 2,6-diaminohexanoic acid.
4. Write the equation for the interaction of alanine with copper hydroxide.
5. Write the equation for the esterification of glycine with methanol.
6. Write the equations for oxidative deamination for alanine and aspartic acid.
7. Write the equations of interaction with nitrous acid for:
a) glycine; b) alanine; c) aspartic acid.
8. Give schemes of reactions proving the amphoteric properties of serine. Which group of α -amino acids (acidic, basic or neutral) does serine belong to? Justify your answer.
9. Write the schemes of the following reactions for valine: a) formation ethyl ether; b) acylation with acetic anhydride; c) with nitrous acid.
10. Write transamination equations for:
a) aspartic and pyruvic acids; b) alanine and glyoxalic acid; c) for pikes and alanine.

Criteria for assessing the current control of progress (Practical tasks)

✓ "Unsatisfactory":

the student does not have practical skills in writing chemical formulas and reactions. I am not familiar with the nomenclature of amino acids, the nature of the chemical bond of protein molecules.

✓ "Satisfactory":

the student has basic skills in compiling chemical formulas of amino acids, is able to identify their projection formulas and belonging to stereochemical series, but makes mistakes and inaccuracies in terminology, in reaction schemes. Unable to give a reasonable answer when characterizing the chemical properties of this class of compounds.

✓ "Good":

the student has theoretical knowledge on this topic, but does not make significant mistakes and shortcomings when writing formulas and equations of chemical reactions. He does not have sufficient skills in working with a textbook, he correctly orients himself in theoretical material, but works slowly.

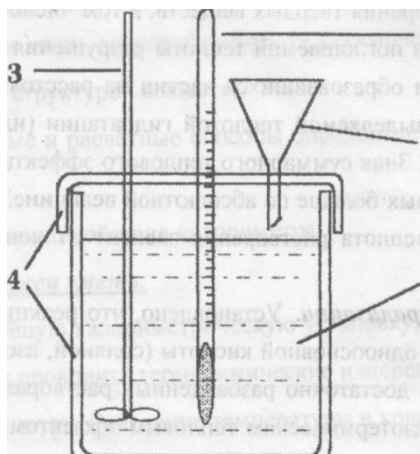
✓ "Excellent":

the student shows a deep and complete knowledge of the entire volume of theoretical material, is able to apply this knowledge to solving a specific task, has chemical literacy and nomenclature, understands the structural features of proteins and molecules, α -amino acids.

Laboratory work

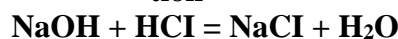
Section 1. : Elements of chemical thermodynamics, thermodynamics of solutions and chemical kinetics.

Controlled competency code (ОПК-5 (ИД-1-ОПК-5)



Laboratory work number 2.

Determination of the standard heat of neutralization reaction



Calorimetric measurements

Calorimetric measurements are based on the laws of Hess and Kirchhoff. The content of calorimetry is the measurement of the thermal effects of chemical reactions and physicochemical processes, the measurement of the heat capacities of systems of various compositions, the establishment of the dependence of thermal effects on state parameters.

Performance of work: measure out 50 ml of 2 M NaOH and HCl solutions with a measuring cylinder, pour into a weighed calorimetric beaker, having previously measured their temperature. Mix the contents of the beaker and note the highest temperature after draining the solutions.

Criteria for assessing the current control of progress (Laboratory work):

The work is considered "credited" if the student correctly and accurately carried out the proposed measurements, entering experimental data and data obtained by mathematical calculations into the appropriate columns. According to the results of the obtained calculations, the thermochemical equation was correctly written, the thermodynamic parameters and the measurement error were determined. Based on these studies, the corresponding conclusions were drawn, confirming the Hess law.

The work " uncredited " if there are errors in the calculations and in the design of the work, in filling out the tables there are violations in units of measurement and designations. Conclusions are drawn that contradict Hess's law. The student does not know the terminology and is not able to state the essence of the problem.

6.2. Intermediate certification based on the results of mastering the discipline

6.2.1. The form of intermediate attestation is a test. Semester II.

6.2.2. The procedure for conducting intermediate certification.

Ticket interview.

6.2.3. Sample questions to prepare for the test

Thermodynamics

1. Thermodynamic systems (isolated, closed, open, homogeneous and heterogeneous).
2. Parameters and functions of the system state. Thermodynamic processes.
3. Internal energy (definition, components, dimension). Enthalpy.
4. The first law (law) of thermodynamics. Formulations. mathematical expression. Heat transfer and work as forms of energy transfer.

5. Thermochemistry. Hess's law and consequences from it. Standard heats of formation and combustion.
6. Thermochemical reaction equations. Thermal effect of a chemical reaction. Exo- and endothermic reactions.
7. Reversible and irreversible processes (reactions). Criteria for spontaneous processes
8. The second law of thermodynamics. Various formulations of it and a mathematical expression.
9. Entropy. The absolute value of entropy. Entropy calculation for a chemical reaction.
10. Gibbs energy. Thermodynamic equilibrium conditions. Exo- and endo-ergonic processes in organisms.
11. The third law (law) of thermodynamics. Enthalpy and entropy factors.

Colligative properties of solutions

1. Colligative properties of solutions (list and characterize each of them).
2. Raoult's law and consequences from it. Ebullioscopic and cryoscopic constants. Methods of ebullioscopy and cryoscopy.
4. Osmosis and osmotic pressure. The role of osmosis and osmotic pressure in biological systems.
5. Van't Hoff's law for non-electrolytes and electrolytes. Isotonic coefficient, its physical meaning.
6. Hypo-, hyper-, isotonic solutions. The phenomenon of plasmolysis, hemolysis and isoosmia.

Buffer systems

1. Buffer action mechanism. Factors that determine the pH of the buffer system.
2. Buffer capacity, factors determining its value.
3. Buffer systems are given: acetate, ammonia, hemoglobin, oxyhemoglobin, phosphate, hydrogen carbonate, amino acid, protein. For each of them, write down: a) composition, b) mechanism of buffering action, c) formula for determining pH, buffering zone and acid and alkali capacity of each buffer.

Carbohydrates

1. The most important monosaccharides: aldopentoses, aldohexoses, ketoses (give examples).
2. Cyclo-chain (oxo-oxy) tautomerism of carbohydrates on the example of glucose and fructose.
3. Maltose disaccharide, its structure, cyclo-chain tautomerism. restorative properties.
4. Disaccharide lactose, its structure, cyclo-chain tautomerism. restorative properties.
5. Disaccharide sucrose, its structure, hydrolysis. The reason for the lack of reducing properties in sucrose itself and their presence in hydrolysis products.
6. The structure of starch, show schematically. Indicate the types of bonds between monosaccharide residues in amylose and amylopectin. Glycogen.

6.2.4. Examples of credit cards

FGBOU VO DSMU of the Ministry of Health of Russia
Department of General and Biological Chemistry
Specialty 33.05.01 - "General Medicine"
Chemistry
Ticket number 29.

1. Oxyhemoglobin buffer system. Give the composition, mechanism of buffer action, formulas for determining pH, buffer zone and buffer capacity for acid and alkali.
2. Complex compound $K_2[Zn(CN)_4]$ is given
 - a) name it
 - b) write down the dissociation equation of a given complex compound as a strong electrolyte, indicate the outer and inner coordination spheres and as a weak electrolyte, indicate the complexing

agent, the structure of the atom and ion of the complexing agent, ligands, the coordination number of the complexing agent;

d) write down for a given complex ion the instability constant, the stability constant and show the mathematical relationship between them

3. Write the reaction equations and name the products of the synthesis of fat containing acyls of stearic, oleic and linoleic acids and its alkaline hydrolysis

4. Homopolysaccharides. Draw a biosegment of the starch polysaccharide chain.

Approved at the meeting of the department, protocol dated " ____ " _____ 2022 ____ . No. ____

Head of the department, MD, prof.

E. R. Nagiev

Compiled by: Ph.D., Assoc.

U. G. Gamzaeva

" ____ " _____ 2022 ____

6.2.5. Description of indicators and criteria for assessing the competence specified in Section 2 at various stages of its formation, description of assessment scales

The grading system includes credits

Criteria evaluation	Evaluation scale	
	"uncredited "	"passed"
Competence code and name of the indicator of achievement of competence ОПК-5 ИД-1 Able to evaluate morpho-functional processes under physiological conditions.		
know	The student is not able to independently single out the main provisions in the studied material of the discipline. He does not know the physico-chemical aspects of the most important biochemical processes and various types of homeostasis in the body: the theoretical foundations of bioenergetics, factors affecting the shift in the balance of biochemical processes.	The student independently singles out the main provisions in the studied material and is able to give a brief description of the main ideas of the studied material of the discipline. Shows an understanding of the physical and chemical foundations of surface phenomena, dispersed systems, macromolecular compounds, their essence, role in metabolism, basic principles of their use in medicine
be able to	The student is not able to predict the direction, completeness and results of chemical and physico-chemical processes, based on the theoretical positions of chemistry, the results of calculations and observations	The student is able to explain the causes and consequences of changes in the direction, completeness and results of chemical and physico-chemical processes occurring in the human body; make physico-chemical measurements that characterize certain properties of solutions, mixtures and medicinal preparations; classify chemical compounds.
own	The student does not own terminology; a technique for conducting qualitative reactions to some biologically important compounds and drugs.	The student shows a deep and complete command of the entire volume of the discipline being studied, owns the terminology; ideas about the main chemical and physico-chemical research methods and technologies used in medicine; skills in analysis and calculation of the parameters of the most important chemical and physico-chemical processes;
Competence code and name of the indicator of achievement of competence ОПК-5 ИД-2 Able to evaluate functional processes in pathological conditions.		

know	The student is not able to use the natural science concepts of the chemical nature, structure and function of biologically important organic compounds (nucleic acids, natural proteins, carbohydrates, fats, water-soluble and fat-soluble vitamins, hormones, etc.) in the interpretation of ensuring the normal functioning of a healthy human body, in the formation of basic physiological indicators that contribute to the preservation and promotion of health.	The student is able to use natural science concepts about the chemical nature, structure and functions of biologically important organic compounds (nucleic acids, natural proteins, carbohydrates, fats, water-soluble and fat-soluble vitamins, hormones, etc.) in the interpretation of ensuring the normal functioning of a healthy human body, in the formation of basic physiological indicators that contribute to the preservation and promotion of health, the prevention of diseases and viral infections: SARS, influenza, COVID - 19.
be able to	The student does not know how to solve typical practical problems and does not know the theoretical minimum at a more abstract level.	The student is able to classify chemical compounds based on their structural formulas; predict the behavior and functions of organic substances in a living organism based on their classification (structure and presence of functional groups); is able to analyze the effect of certain drugs on the basis of the classification affiliation of its functional group and structure.
own	Does not own ideas about the main natural-scientific research methods and technologies used in medicine; skills in analyzing and calculating the parameters of the most important chemical and physico-chemical processes.	Owens ideas about the main natural scientific research methods and technologies used in medicine; skills of analysis and calculation of the parameters of the most important chemical and physico-chemical processes.

VII. EDUCATIONAL AND METHODOLOGICAL AND INFORMATION SUPPORT FOR DISCIPLINE

7.1. Main literature

Printed publications

№	Name of publication	Number of copies in the library
1	Fundamentals of bioorganic chemistry: textbook for medical students/ S. E. Zurabyan. – Moscow: GEOTAR-Media, 2012. – 304 p. ISBN 978-5-9704-3443-7	50

Electronic editions

№	Name of publication
1.	Chemistry [Electronic resource]: textbook / Puzakov S.A. - 2nd ed., corrected. and additional - Moscow: GEOTAR-Media, 2006. - Access by login and password. - URL: http://www.studmedlib.ru/book/ISBN5970401986.html .- Text: electronic
2	Tyukavkina N.A., Bioorganic chemistry [Electronic resource]: textbook / N.A. Tyukavkina, Yu.I. Baukov, S.E. Zurabyan. - Moscow: GEOTAR-Media, 2015. - 416 p. - ISBN 978-5-9704-3188-7 - Login and password access.– URL: http://www.studmedlib.ru/book/ISBN9785970431887.html - .- Text: electronic

7.2. Additional literature

Printed sources

№	Editions	Number of copies in the library
1	Tyukavkina N.A. Bioorganic chemistry: a textbook for honey. universities / N. A. Tyukavkina .- Moscow: Medicine Publishing House. 2010. - 416s. -ISBN978-5-9704-1773-7. – Text : direct.	415

Электронные издания

№	Наименование издания
1	Bioorganic chemistry: a guide to practical exercises: a textbook / edited by N. A. Tyukavkina. - Moscow: GEOTAR-Media, 2016. - 168 p. - ISBN 978-5-9704-3801-5. –Access login and password.-URL: http://www.studmedlib.ru/book/ISBN9785970438015.html . – Text: electronic.
2	Chemistry of biogenic elements: a teaching aid for students of medical universities / FGBOU VO VSMU named after V.I. N. N. Burdenko; compilers: V. M. Klokov, N. I. Ponomareva, N. M. Ovechkina [and others]. - Voronezh: VSMU, 2019. - 58 p. - Access login and password-URL: http://lib1.vrngmu.ru:8090/MegaPro/Download/MObject/809 . – Text: electronic.

7.3. Resources of the information and telecommunications network "Internet"

<https://lms.dgmu.ru/course/view.php?id=265#>

Адрес сайта кафедры: <https://dgmu.ru/fakultety/farmatsevticheskij-fakultet-3/obshhej-i-biologicheskoy-himii>

- Chemlib.ru, Chemist.ru, ACDLabs, MSU.Chem.ru., etc.

- ELS "Student Consultant" <http://www.studmedlib.ru/> (login for registered users through the portal of the DSMU website <http://www.dgmu.ru/>)

7.4. Information Technology

Software list (Win HOME 10 Russian OLP (Sublicense Agreement Tr000044429 dated 12/08/18); Kaspersky Edition Security for Business - Standard Russian Edition. 100-149 Node (License Agreement No. 1081-2015 dated 10/14/2018); Office ProPlus 2013 RUS OLP NL Acdmc (Contract No. DP-026 dated 10/16/18), etc.)

List of information reference systems:

Electronic Information and Educational Environment (EIOS) of DSMU.- Password access mode - URL: <https://lms.dgmu.en>

Student Advisor: Electronic Library System. .- Password access mode - URL: <http://www.studentlibrary.ru>

Federal Electronic Medical Library (FEMB). .- Password access mode - URL: <http://feml.scsml.rssi.ru>

Scientific electronic library eLibrary. .- Password access mode -URL: <https://elibrary.ru/defaultx.asp>

Scientific electronic library CyberLeninka. .- Password access mode - URL: <http://cyberleninka.ru>

RFBR electronic library. .- Password access mode - URL: <http://www.rfbr.ru>

VIII. MATERIAL AND TECHNICAL SUPPORT OF THE DISCIPLINE

N п/п	Type of room with number	Name of equipment
1.	Laboratory No. 3 - for conducting laboratory classes, 45 m ² st. Shamilya 48, educational and	1. Laboratory tables, chairs, board. 2. Hood. 3. Cabinets for dishes.

	laboratory building, 2nd floor	4. Cabinets for reagents. 5. Table for titration. 6. Racks with burettes. 7. Laboratory glassware (test tubes, pipettes, glass slides, glass rods, titration flasks, funnels, filters, etc.). 8. Electrical appliances (stove, water bath, stirrer, dish dryer, etc.)
2.	Lecture hall No. 1 - for conducting lectures, 100 m ² st. Shamilya 48, educational and laboratory building, 1st floor	Multimedia complex (laptop, projector, screen)
3.	Reading rooms - for independent work. st. A.Aliyeva 1, biological building, 1st floor, scientific library of the DSMU	Tables, chairs, computers for working with electronic resources of the library, educational, scientific, periodical literature.

IX. USE OF INNOVATIVE (ACTIVE AND INTERACTIVE) LEARNING METHODS

The active and interactive teaching methods used in the study of this discipline make up about 67% of the volume of classroom studies, since almost every lesson involves laboratory experiments, problem solving, and practical assignments.

№ п/п	Title of the discipline section	Type, name of the topic of the lesson using forms of active and interactive teaching methods	Labor intensity (hour)
1.1	General chemistry. Biologically active low molecular weight inorganic substances (structure, properties, participation in the functioning of living systems).	PC.1. Biogenic elements. complex compounds. LS.1. Complex compounds and their properties.	2
1.2	Elements of chemical thermodynamics, thermodynamics of solutions and chemical kinetics.	PC.2 Chemical thermodynamics LS.2. Determination of the thermal effect of a chemical reaction	2
1.3	The main types of chemical equilibria and processes in the functioning of living systems.	PC.3. Solutions. Colligative properties of solutions. LS.3 Osmosis, osmotic pressure. Growth of an artificial Traube cell	2
		PC.4 Acid-base balance. Salt hydrolysis LZ.4. Acid-base balance. Typical cases of salt hydrolysis	2
		PS.5. Buffer systems. Buffer capacity. LZ.5. Properties of buffer solutions.	2
		PC.7. Heterogeneous processes and equilibrium. LS.6. Study of the conditions of dissolution and formation of precipitates.	2

1.4	Physical chemistry of surface phenomena in the functioning of living systems.	PC.8. Surface phenomena. L.7 Sorption phenomena	2
1.5	Physical chemistry of dispersed systems in the functioning of living systems.	PC.9. Disperse systems. colloidal solutions. LS.8. Obtaining and properties of colloidal solutions. Coagulation of colloids by electrolytes.	2
2.1	Bioorganic chemistry. Poly- and hetero-functional compounds involved in the processes of vital activity.	PC.10. Poly- and heterofunctional compounds. Nitrogen-containing biologically important heterocyclic compounds. LS.9. Discovery of oxalic acid as a calcium salt. Formation of a chelate compound of tartaric acid with copper(II) hydroxide.	3 1
		PC.11. Saponifiable lipids. L.10. Oxidation of oleic acid with a solution of potassium permanganate.	2
2.2	Biopolymers and their structural components.	PC.12. α -amino acids LS.11. Qualitative reactions to α -amino acids	2
		PC.13. Proteins and peptides.	2
		PC.14. Carbohydrates. Monosaccharides.	2
		PC.15. Di- and polysaccharides. LS.12 Trommer's test, Selivanov's reaction, reduction of ammonia solution of silver hydroxide with glucose, lack of reducing ability of sucrose. Qualitative reaction to starch.	2
		PC.16. Nucleic acids.	2
		PC.17. Line control.	2

X. METHODOLOGICAL SUPPORT OF THE DISCIPLINE

Workshop on general chemistry. Biophysical chemistry. Chemistry of biogenic elements. Textbook for students of medical universities (Ed. V.A. Popkov, A.V. Babkov). – Moscow: Yurayt, 4th ed., 239 p., 2018

XI. FEATURES OF THE ORGANIZATION OF DISCIPLINE TRAINING FOR DISABLED PEOPLE AND PERSONS WITH LIMITED HEALTH OPPORTUNITIES

11.1. Education of disabled people and persons with disabilities

If necessary, it is carried out by the department on the basis of an adapted work program using special teaching methods and didactic materials, compiled taking into account the characteristics of the psychophysical development, individual capabilities and health status of such students (student).

11.2. In order to master the curriculum of the discipline for people with disabilities and people with disabilities, the department provides:

- 1) for the disabled and persons with visual impairments:
 - placement in accessible places for students who are blind or visually impaired, and in an adapted form of reference information about the schedule of training sessions;
 - the presence of an assistant providing the student with the necessary assistance;
 - release of alternative formats for methodological materials (large print or audio files);
- 2) for the disabled and people with hearing disabilities:

- appropriate sound means of reproduction of information;

3) for disabled people and persons with disabilities who have disorders of the musculoskeletal system:

- the possibility of unimpeded access of students to classrooms, toilet rooms and other premises of the department. In case of impossibility of unhindered access to the department, organize the educational process in a specially equipped center for individual and collective use of special technical training aids for the disabled and persons with disabilities (A.Aliyev str. 1, biological building, 1st floor, scientific library DSMU).

11.3. The education of students with disabilities can be organized both jointly with other students and in separate groups.

11.4. The list of educational and methodological support for independent work of students in the discipline.

Educational and methodological materials for independent work of students from among the disabled and persons with disabilities are provided in forms adapted to the limitations of their health and perception of information:

Categories of students	Forms
hearing loss	- in printed form; - in the form of an electronic document;
visually impaired	- in printed form in enlarged type; - in the form of an electronic document; - in the form of an audio file;
With a violation of the musculoskeletal system	- printed form; - in the form of an electronic document;

This list can be specified depending on the contingent of students.

11.5. Fund of assessment tools for conducting intermediate certification of students in the discipline.

11.5.1. List of funds for evaluation funds correlated with the planned results of the development of the educational program.

For students with disabilities

Categories of students	Types of evaluation tools	Forms of control and evaluation of learning outcomes
Hearing impaired	Test	Predominantly written review
Visually impaired	Interview	Predominantly oral examination (individually)
With a violation of the musculoskeletal system	Solving remote tests, control questions	Organization of control in the EIOS DSMU, written verification

Students with disabilities and persons with disabilities are given more time to prepare answers for the test, they are allowed to prepare for the test using distance learning technologies.

11.5.2. Methodological materials that determine the procedures for assessing knowledge, skills and (or) experience of activity, characterizing the stages of the formation of competencies.

When carrying out the procedure for evaluating the learning outcomes of people with disabilities and persons with disabilities, the use of technical means necessary for them in connection with their individual characteristics is envisaged.

The procedure for evaluating the learning outcomes of people with disabilities and people with disabilities in the discipline provides for the provision of information in forms adapted to the limitations of their health and perception of information:

For persons with visual impairments:

- in printed form in enlarged type;
- in the form of an electronic document;
- in the form of an audio file.

For people with hearing impairments:

- in printed form;
- in the form of an electronic document.

For people with musculoskeletal disorders:

- in printed form;
- in the form of an electronic document;
- in the form of an audio file.

This list can be specified depending on the contingent of students.

When carrying out the procedure for evaluating the learning outcomes of people with disabilities and persons with disabilities in a discipline (module), the following additional requirements are met, depending on the individual characteristics of students:

1. instruction on the procedure for conducting the assessment procedure is provided in an accessible form (orally, in writing, orally using the services of a sign language interpreter);
2. an accessible form for providing assignments of assessment tools (in printed form, in printed form in an enlarged font, in the form of an electronic document, assignments are read by an assistant, assignments are provided using sign language translation);
3. an accessible form of providing answers to tasks (in writing on paper, a set of answers on a computer, using the services of an assistant, orally).

If necessary, for students with disabilities and the disabled, the procedure for evaluating learning outcomes in a discipline (module) can be carried out in several stages.

The procedure for evaluating the learning outcomes of people with disabilities and persons with disabilities is allowed using distance learning technologies.

11.6. The list of basic and additional educational literature necessary for the development of the discipline.

In order to master the discipline, disabled people and persons with disabilities are provided with basic and additional educational literature in the form of an electronic document in the library fund and / or in electronic library systems. Also, special textbooks and teaching aids, other educational literature and special technical training aids for collective and individual use, as well as the services of sign language and sign language interpreters are provided free of charge.

11.7. Guidelines for students on mastering the discipline

Individual work is of great importance in mastering the discipline by disabled people and persons with disabilities. Individual work refers to two forms of interaction with a teacher: individual educational work (consultations), i.e. additional explanation of the educational material and in-depth study of the material with those students who are interested in this, and individual educational work. Individual consultations on the subject are an important factor contributing to the individualization of education and the establishment of educational contact between the teacher and a student with a disability or a student with disabilities.

11.8. Description of the material and technical base necessary for the implementation of the educational process in the discipline

Discipline mastering by people with disabilities and persons with disabilities is carried out using general and special-purpose learning tools:

- lecture audience - multimedia equipment, mobile radio class (for students with hearing impairments); power supplies for individual technical means;
- classroom for practical classes (seminars), multimedia equipment, mobile radio class (for students with hearing impairments);
- classroom for independent work - standard workplaces with personal computers; workplace with a personal computer, screen reader, screen magnifier and braille display for visually impaired students.

In each classroom where people with disabilities and people with disabilities study, an appropriate number of places for students should be provided, taking into account their health limitations.

XII. CHANGES LIST

List of additions and changes made to the work program of the discipline	RP updated at the meeting of the department		
	Date	Number of minutes of the meeting of the department	Signature of the head of the department
<p>The following changes are made to the work program</p> <p>1.;</p> <p>2..... etc.</p> <p>or a note is made about the inappropriateness of making any changes for this academic year</p>			