Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of Higher Education
«St. Petersburg State University of Veterinary Medicine»

APPROVED BY
Vice-Rector for Educational
Work and Youth Policy
_____ A.A. Sukhinin
May 6, 2024

Department of biochemistry and physiology

EDUCATIONAL WORK PROGRAM
for the discipline
« ORGANIC, PHYSICAL AND COLLOIDAL CHEMISTRY»

The level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary Medicine
Full-time education
Education starts in 2024

Reviewed and adopted
at the meeting of the department
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Protocol No. 13

Head of the dep. of biochemistry and physiology
Doctor of Biological Sciences, professor
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Saint Petersburg
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1. AIMS AND OBJECTIVES OF DICIPLINE

The main purpose of the discipline in the training of veterinarians is for students to acquire knowledge about the patterns of structure and reactivity of the main classes of organic compounds; the role and distribution of organic compounds in nature, human use in practice.

To achieve this goal, it is necessary to solve the following tasks:

a) The general educational task is to familiarize students in-depth with the patterns of structure and reactivity of the main classes of organic compounds; the role and distribution of organic compounds in nature, human use in practical activities and provides fundamental biological education in accordance with the requirements for higher educational institutions of a biological profile.

b) The applied task highlights issues related to laboratory assessment and creates a conceptual framework for the implementation of interdisciplinary structural and logical connections in order to develop medical thinking skills.

c) A special task is to familiarize students with modern trends and methodological approaches used in organic and physico-colloidal chemistry to solve problems of animal husbandry and veterinary medicine, as well as existing achievements in this field.

2. LIST OF PLANNED LEARNING OUTCOMES FOR THE SUBJECT (MODULE), ALIGNED WITH THE PLANNED OUTCOMES OF THE EDUCATIONAL PROGRAM

In result of completion of the discipline, the student is prepared for professional activities in accordance with the educational standard of the Federal State Educational Standard for Higher Education 36.05.01 "Veterinary Medicine".

Types of professional activity:

- improvement of the methodology of scientific research, development and implementation of innovative technologies in the field of veterinary medicine and animal husbandry;
- collection of scientific information, preparation of reviews, annotations, preparation of abstracts and reports, bibliographies, analysis of information on research objects;
- participation in scientific discussions and procedures for the protection of scientific papers of various levels;
- presentation of reports and presentations on the subject of ongoing research, dissemination and popularization of professional knowledge, educational work with students;
- analysis of the state and dynamics of the objects of activity, development of plans, programs and research methods, analysis of their results.

The student's expertises formed as a result of mastering the discipline:

A) Universal competencies (UC):

- **UC -1:** Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation.
  - **UC-1$_{ID-1}$:** To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis;
  - **UC-1$_{ID-2}$:** To be able to gain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional

field; search for information and solutions based on actions, experiment, experience, and information and communication technologies;

- **UC-1$_{ID-3}$:** To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve problematic professional situations.

B) General professional competencies (GPC):

- **GPC-4:** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.
  - **GPC-4$_{ID-1}$:** To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity;
  - **GPC-4$_{ID-2}$:** To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained;
  - **GPC-4$_{ID-3}$:** To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

3. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF THE MPEP

The discipline B1.O.15 «Organic, physical and colloid chemistry» is a discipline of the obligatory part of the federal state educational standard of higher education in the specialty 36.05.01 "Veterinary medicine" (education level specialty).

Dicipline is studied at courses:

1. Full-time education – 1 course, 2 semester;

During studying the discipline "Organic, physical and colloidal chemistry", the knowledge and skills acquired by students during the studying disciplines of biological physics, inorganic and analytical chemistry, biology with the basics of ecology are used.

The discipline of Organic, Physical and Colloidal Chemistry is the basic one on which most subsequent disciplines are based, such as:

1. Biological chemistry
2. Vitaminology and fermentology in veterinary
3. Physiology и ethology of animals
4. Veterinary farmacology
5. Pathological physiology
6. Animal nutrition with the basics of reproduction
7. Laboratory diagnostics
8. Clinical diagnostics

4. THE SCOPE OF THE DISCIPLINE "ORGANIC, PHYSICAL AND COLLOIDAL CHEMISTRY" FOR FULL-TIME EDUCATION

Type of educational activity	**Total hours**	**Semesters**
		2nd semester
Classroom classes (total)	**72**	**72**
Including:		
Lectures, including interactive forms	34	34
Practical classes (PC), including interactive forms, of which:	34	34
Practical preparation (PP)	8	8
Self-study (total)	**76**	**76**
Exams	+	+
Type of midterm assessment (credit, exam)	**Exam**	**Exam**
Total workload hours / credit units	**144/4**	**144/4**

5.1 THE CONTENT OF THE DISCIPLINE AND TYPES OF CLASSES FOR FULL-TIME EDUCATION

№	Topic	Formed expertises	Semester	Types of academic work, including students out-of-class learning and workload (hours)			
				Lectures	Practical lessons	Practical training	Self-study
1.	Fundamentals of physical colloidal chemistry	UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation **UC-1$_{ID-1}$ To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis.** GPC-4: Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. **GPC-4$_{ID-1}$ To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.**	2	6	6	2	26
2.	Introduction to organic chemistry. Hydrocarbons.	UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation **UC-1$_{ID-2}$ To be able to gain new knowledge**	2	6	6	2	10

3.	Alcohols, phenols, aldehydes, ketones	**based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional field; search for information and solutions based on actions, experiment, experience, and information and communication technologies.;** GPC-4: Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. . **GPC-4$_{ID-2}$** To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	2	6	2	2	10
4.	Carboxylic acids		2	4	4		10
5.	Lipids, carbohydrates	UC-1: Is able to carry out a critical analysis of problematic situations	2	6	4	2	10

6.	Amino acids, proteins, nucleic acids	based on a systematic approach, to develop a strategy for manipulation **UC-1$_{ID-3}$ To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve problematic professional situations..** GPC-4: Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.. **GPC-4$_{ID-3}$ To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well..**	2	6	4		10
TOTAL FOR 1ST COURSE, 2ND SEMESTER				**34**	**26**	**8**	**76**

6. THE LIST OF EDUCATIONAL AND METHODOLOGICAL SUPPORT FOR STUDENTS' SELF WORK

6.1 Guidelines for self -work

1. Vasilyeva, Svetlana Vladimirovna. Hydrocarbons : studies.- the method. the manual / SPbGAVM. - St. Petersburg : Publishing House of SPbSAVM, 2014. - 49 p.
2. Organic chemistry : method. the decree. and counter. tasks for the student. vet. fac. (part-time. form of education) / author-comp.: N. V. Pylaeva, B. M. Fedorov, S. V. Vasilyeva. - St. Petersburg : Publishing House of SPbSAVM, 2013. - 59 p..
3. Organic, physical and colloid chemistry : учебное пособие / I. A. Sazonova, O. S. Larionova, Y. B. Drevko, T. S. Osina. — Саратов : Вавиловский университет, 2019. — 52 с. — ISBN 978-5-9999-3269-3. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/137501 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)
4. Selivanova, N. M. Physical Chemistry : учебное пособие / N. M. Selivanova, A. N. Bezrukov, Y. G. Galyametdinov. — Казань : КНИТУ, 2017. — 151 с. — ISBN 978-5-7882-2243-1. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/138379 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)

6.2 Literature for self-work

1. Berezin, D.B. Organic chemistry [Electronic resource] : textbook / D.B. Berezin, O.V. Shukhto, S.A. Syrbu [et al.]. — Electron. dan. — St. Petersburg : Lan, 2014. — 238 p. — Access mode: http://e.lanbook.com/books/element.php?pl1_id=44754 — Cover from the screen(accessed: 04/27/2024)
2. Denisov, V.Ya. Collection of problems in organic chemistry [Electronic resource] : textbook / V.Ya. Denisov, D.L. Muryshkin, T.B. Tkachenko [et al.]. — Electron. dan. — St. Petersburg : Lan, 2014. — 538 p. — Access mode: http://e.lanbook.com/books/element.php?pl1_id=45971 — Cover from the screen(accessed: 04/27/2024)
3. Tyukavkina, Nonna Arsenyevna. Bioorganic chemistry : textbook ; rec. UMO. - M. : GEOTAR-Media, 2010. - 416 p. - ISBN 978-5-9704-1415-6.
4. Davydova, M. K. Bioorganic chemistry and research methods of organic compounds : учебное пособие / M. K. Davydova. — Санкт-Петербург : СПбГПМУ, 2018 — Часть II : Carbonyl compounds. Carboxylic, hydroxy- and oxoacids. Mass spectrometry. Nuclear magnetic resonance spectroscopy — 2018. — 52 с. — ISBN 978-5-907065-30-7. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/174563 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)
5. Davydova, M. K. Bioorganic chemistry and research methods of organic compounds : учебное пособие / M. K. Davydova. — Санкт-Петербург : СПбГПМУ, 2018 — Часть III : Carbohydrates. Amino acids. Peptides. Nucleic acids. Chromatography — 2018. — 64 с. — ISBN 978-5-907065-31-4. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/174564 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)

6. Davydova, M. K. Bioorganic chemistry and research methods of organic compounds : учебное пособие / M. K. Davydova. — Санкт-Петербург : СПбГПМУ, 2018 — Часть I : Hydrocarbons and heterocyclic compounds and their functional derivative — 2018. — 72 с. — ISBN 978-5-907065-29-1. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/174562 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)

7. THE LIST OF BASIC AND ADDITIONAL LITERATURE NECESSARY FOR THE DEVELOPMENT OF THE DISCIPLINE "ORGANIC, PHYSICAL AND COLLOIDAL CHEMISTRY"

A) Basic literature:

1. Grandberg, Igor I. Organic chemistry : rec. UMO ; studies. for universities. - 7th ed., revised. and additional - M. : Dropha, 2009. - 607 p. : ill. - (Higher education). - ISBN 978-5-358-06141-5.
2. Mikryukova, E. Y. Organic chemistry : a textbook / E. Y. Mikryukova, A.V. Zharekhina, N. R. Kasanova. — Kazan : KSAVM named after Bauman, 2019. — 102 p. — Text : electronic // Lan : electronic library system. — URL: https://e.lanbook.com/book/144261 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)
3. Talipov, R. F. Lectures in modern organic chemistry: tutorial : учебное пособие / R. F. Talipov. — Уфа : УГНТУ, 2017. — 263 с. — ISBN 978-5-7831-1571-4. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/166908 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)
4. Khorunzhij, V. V. Physical and Colloidal Chemistry : учебное пособие / V. V. Khorunzhij. — Санкт-Петербург : СПбГПМУ, 2018. — 32 с. — ISBN 978-5-907065-57-4. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/174617 — Access mode: for authorization. users. Cover from the screen(accessed: 04/27/2024)

B) Additional literature:

1. Fundamentals of organic chemistry : a textbook / M. G. Safarov, F. A. Valeev, V. G. Safarova, L. H. Fayzullina. — 2nd ed., reprint. and add. — St. Petersburg : Lan, 2019. — 532 p. — ISBN 978-5-8114-3321-6. — Text : electronic // Lan : electronic library system. — URL: https://e.lanbook.com/book/113905 Access date: 06/26.23.— Access mode: for authorization. users.
2. Harwood, Lawrence. Visual organic chemistry : studies. the manual ; rec. UMO / edited by N.A. Tyukavkin, S.E. Zurabyan ; translated from English by S.E. Zurabyan. - M. : GEOTAR-Media, 2008. - 112 p. : ill. - ISBN 978-5-9704-0817-9(accessed: 04/27/2024)
3. Davydova, M. K. Bioorganic chemistry and research methods of organic compounds : учебное пособие / M. K. Davydova. — Санкт-Петербург : СПбГПМУ, 2018 — Часть II : Carbonyl compounds. Carboxylic, hydroxy- and oxoacids. Mass spectrometry. Nuclear magnetic resonance spectroscopy — 2018. — 52 с. — ISBN 978-5-907065-30-7. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/174563 — Access mode: for authorization. users. Cover from the screen. Access date: 26.04.24
4. Davydova, M. K. Bioorganic chemistry and research methods of organic compounds : учебное пособие / M. K. Davydova. — Санкт-Петербург : СПбГПМУ, 2018 — Часть III

: Carbohydrates. Amino acids. Peptides. Nucleic acids. Chromatography — 2018. — 64 c. — ISBN 978-5-907065-31-4. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/174564 — Access mode: for authorization. users. Cover from the screen. Access date: 26.04.24

5. Davydova, M. K. Bioorganic chemistry and research methods of organic compounds : учебное пособие / M. K. Davydova. — Санкт-Петербург : СПбГПМУ, 2018 — Часть I : Hydrocarbons and heterocyclic compounds and their functional derivative — 2018. — 72 с. — ISBN 978-5-907065-29-1. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/174562 — Access mode: for authorization. users. Cover from the screen. Access date: 26.04.24

8. THE LIST OF RESOURCES OF THE INFORMATION AND TELECOMMUNICATION NETWORK "INTERNET" NECESSARY FOR EDUCATION OF THE DISCIPLINE

To be prepared for practical classes and perform independent work, students can use the following online resources:

1. http://orgchem.ru/ Organic chemestry: e-textbook
2. http://www.alhimik.ru/teleclass/content.shtml - website alchemist
3. http://www.hemi.nsu.ru/index.htm - basics of chemestry - e-textbook
4. http://www.himikatus.ru/index.php - chemical website

Electronic library systems:

1. EBS «SPbGUVM»
2. EBS publishing house «Lan»
3. EBS «Student's consultant»
4. Legal reference system «Consultant»
5. University information system «RUSSIA»
6. Full-text database POLPRED.COM
7. Scientific electronic library ELIBRARY.RU
8. Russian scientific Network
9. Electronic library system IQlib
10. Database of international scientific indexes quoting Web of Science
11. Full-text interdisciplinary database on agricultural and environmental sciences ProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE
12. Electronic books from publishing house «Prospekt Nauki» http://prospektnauki.ru/ebooks/
13. Collection «Agricultural industry. Veterinary medicine" publishing house «Quadro» http://www.iprbookshop.ru/586.html

9. METHODOLOGICAL GUIDELINES FOR STUDENTS ON EDUCATION OF THE DISCIPLINE

Methodological recommendations for students are a set of recommendations and explanations that allow the student to optimally organize the process of studying this discipline.
The content of methodological recommendations, generally, may include:

- Advices on planning and organizing the time needed to study the discipline. Description of the sequence of actions of the student, or the "scenario of studying the discipline".».

Morning time is the most productive for academic work (from 8-14 o'clock), followed by afternoon time (from 16-19 o'clock) and evening time (from 20-24 o'clock). The most difficult material is recommended to be studied at the beginning of each time interval after rest. After 1.5 hours of work, a break is required (10-15 minutes), after 4 hours of work, the break should be 1 hour. Part of the scientific organization of labor is the mastery of the technique of mental labor. Normally, a student should devote about 10 hours a day to studying (6 hours at university, 4 hours at home).

Recommendations for working on lecture material

During preparing for a lecture, the student is recommended:

1) view the recordings of the previous lecture and restore the previously studied material in memory

2) it is useful to review the upcoming material of a future lecture

3) if an independent study of individual fragments of the topic of the last lecture is set, then it must be completed without delay;

4) psychologically set on the lecture.

This work includes two main stages: note-taking and further work on lecture material.

Note-taking means making a summary, that is, a brief written statement of the content of something (an oral presentation – a speech, lecture, report, etc. or a written source – a document, article, book, etc.).

The methodology of work when taking notes of oral presentations differs significantly from the methodology of work when taking notes of written sources.

By taking notes of written sources, the student has the opportunity to repeatedly read the desired passage of the text, reflect on it, highlight the main thoughts of the author, briefly formulate them, and then write them down. If necessary, he can also note his attitude to this point of view. Listening to the lecture, the student should postpone most of the complex of the above–mentioned works for another time, trying to use every minute to record the lecture, and not to comprehend it - there is no time left for this. Therefore, when taking notes of a lecture, it is recommended to separate fields on each page for subsequent entries in addition to the summary.

After recording a lecture or making a summary of it, you should not leave work on the lecture material before preparing for the test. It is necessary to do as early as possible the work that accompanies taking notes of written sources and which could not be done during the recording of the lecture - read your notes, deciphering individual abbreviations, analyze the text, establish logical connections between its elements, in some cases show them graphically, highlight the main thoughts, mark issues requiring additional processing, in particular, the teacher's consultations.

During the work on the text of the lecture, the student should pay special attention to the problematic issues raised by the teacher during the lecture, as well as to his assignments and recommendations. For each lecture, practical lesson and laboratory work, the number, topic, list of issues under consideration, volume in hours and links to recommended literature are provided. For classes conducted in interactive forms, their organizational form should be indicated: computer simulation, business or role-playing game, analysis of a specific situation, etc.

Recommendations for preparing for practical classes

Practical (seminar) classes are an important part of the professional training of students. The main purpose of conducting practical (seminar) classes is to form students' analytical, creative thinking through the acquisition of practical skills. Practical classes are also conducted in order to

deepen and consolidate the knowledge gained in lectures and in the process of independent work on normative documents, educational and scientific literature. When preparing for a practical lesson for students, it is necessary to study or repeat theoretical material on a given topic.

During preparation to a practical lesson the student is recommended to follow the following algorithm;

1) get acquainted with the plan of the upcoming lesson;

2) to study the literature sources that have been recommended and familiarize yourself with the introductory notes to the relevant sections.

Methodological guidelines for practical (seminar) classes in the discipline, along with the work program and schedule of the educational process, refer to methodological documents that determine the level of organization and quality of the educational process.

The content of practical (seminar) classes is recorded in the working curricula of the disciplines in the sections "List of topics of practical (seminar) classes".

The most important component of any form of practical training is tasks.

The basis of the assignment is an example that is understood from the standpoint of the theory developed in the lecture. As a rule, the main attention is paid to the formation of specific skills, which determines the content of students' activities - problem solving, laboratory work, clarification of categories and concepts of science, which are prerequisites for correct thinking and speech.

Practical (seminar) classes perform the following tasks:

- they stimulate regular study of recommended literature, as well as an attentive attitude to the lecture course;
- consolidate the knowledge gained in the process of lecture training and independent work on literature;
- expand the scope of professionally significant knowledge, skills, and abilities;
- allow you to check the correctness of previously acquired knowledge;
- instill the skills of independent thinking, verbal presentation;
- contribute to the free operation of terminology;
- provide the teacher with the opportunity to systematically monitor the level of independent work of students.

Methodological guidelines for practical (seminar) classes in the discipline should be focused on modern business conditions, current regulatory documents, advanced technologies, the latest achievements of science, technology and practice, modern ideas about certain phenomena, the studied reality.

• Recommendations for working with literature.

Working with literature is an important stage of a student's independent work on mastering a subject, contributing not only to the consolidation of knowledge, but also to the expansion of horizons, mental abilities, memory, the ability to think, express and confirm their hypotheses and ideas. In addition, the skills of research work necessary for further professional activity are being developed.

Getting started with studying the literature on the topic, it is necessary to make notes, extracts, notes. It is mandatory to take notes of the works of theorists, which allow us to comprehend the theoretical basis of the study. For the rest, you can limit yourself to extracts from the studied sources. All extracts and quotations must have the exact "return address" (author, title of the work, year of publication, page, etc.). It is advisable to write an abbreviated title of the question to which the extract or quotation refers. In addition, it is necessary to learn how to immediately compile a file

of special literature and publications of sources, both proposed by the teacher and identified independently, as well as refer to bibliographic reference books, chronicles of journal articles, book chronicles, abstract journals. At the same time, publications of sources (articles, book titles, etc.) should be written on separate cards, which must be filled in according to the rules of bibliographic description (surname, initials of the author, title of the work. Place of publication, publisher, year of publication, number of pages, and for journal articles – the name of the journal, year of publication, page numbers). На каждой карточке целесообразно фиксировать мысль автора книги или факт из этой книги лишь по одному конкретному вопросу. If the work, even in the same paragraph or phrase, contains more judgments or facts on another issue, then they should be written out on a separate card. The presentation should be concise, accurate, without subjective assessments. On the back of the card, you can make your own notes about this book or article, its content, structure, on which sources it is written, etc.

• Explanations about working with control and test materials on course, recommendations for completing homework.

Testing is a test that allows you to determine whether the actual behavior of the program corresponds to the expected one by performing a specially selected set of tests.

Test - is the fulfillment of certain conditions and actions necessary to verify the operation of the function under test or part of it. Each question in the discipline must be answered correctly by choosing one option.

10. EDUCATIONAL SOCIAL WORK

Within the bounds of the discipline, tutorial work is carried out to form a modern scientific worldview and a system of basic values, the formation and development of spiritual and moral, civil and patriotic values, a system of aesthetic and ethical knowledge and values, attitudes of tolerant consciousness in society, the formation of students' need for work as the first vital necessity, the highest value and the main way to achieve to achieve success in life, to realize the social significance of your future profession.

11. THE LIST OF INFORMATION TECHNOLOGIES USED IN THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS

11.1. The use of information technologies is provided in the educational process of the discipline:

- ✓ conducting practical classes using multimedia;
- ✓ interactive technologies (conducting dialogues, collective discussion of various approaches to solving a particular educational and professional task);
- ✓ interaction with students via e - mail;
- ✓ joint work in the Electronic information and educational environment of SPbSUVM : https://spbguvm.ru/academy/eios/

11.2. Software

The list of licensed and freely distributed software, including domestic production

№ п/п	Name of the technical and computer training tools recommended by sections and topics of the program	Licence
1	MS PowerPoint	67580828
2	LibreOffice	free software
3	OS Alt Education 8	AAO.0022.00
4	ALIS "MARK-SQL"	02102014155

5	MS Windows 10	67580828
6	System ConsultantPlus	503/KL
7	Android OC	free software

12. MATERIAL AND TECHNICAL BASE NECESSARY FOR THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS IN THE DISCIPLINE

The title of the discipline (module), practice in accordance with the curriculum	The title of special rooms and rooms for self-work	Equipment of special rooms and rooms for self-work
Organic, physical and colloidal chemistry	**103** (99 Moskovsky Prospekt, St. Petersburg, 196084) 43,1 м^2/ 30seats. A classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:* desks, chairs, tabouret, educational board. *Technical training tools:* Samsung interactive display (model WM85R).
	104 (99 Moskovsky Prospekt, St. Petersburg, 196084) 43,1 м^2/ 30seats. A classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:* desks, chairs, tabouret, educational board. *Technical training tools:* fume hood, thermostat, CPC-3 «ZOMP»
	105 (99 Moskovsky Prospekt, St. Petersburg, 196084) 30,1м^2/ 30 seats. A classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:* desks, chairs, tabouret, educational board. *Technical training tools:* fume hood, thermostat, CPC-3 «ZOMP»
	106a (99 Moskovsky Prospekt, St. Petersburg, 196084) 50,2 m^2/ 30 seats. A classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:* desks, chairs, tabouret, educational board. *Technical training tools:* The fume hood, thermostat
	106б (99 Moskovsky Prospekt, St. Petersburg, 196084) 30,5 м^2/ 30 seats. A classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:* desks, chairs, tabouret, educational board. *Technical training tools:* fume hood, thermostat
	112 (99 Moskovsky Prospekt, St. Petersburg, 196084) 29,4 м^2/ 30 seats. A classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:* desks, chairs, tabouret, educational board.

	101 (99 Moskovsky Prospekt, St. Petersburg, 196084) Laboratory of the Department 14,4 м^2	*Specialized furniture:* столы, chairs, closets. *Technical training tools:* table scales, centrifuge, PC CPC-3.
	010 (99 Moskovsky Prospekt, St. Petersburg, 196084) Washing of the Department 14 м^2	*Specialized furniture:* столы, chairs, shelving, closets. *Technical training tools:* electric stove, double sink with drain, drying cabinet, electric water heater.
	206 Large reading room (196084, St. Petersburg, Chernigovskaya str., 5) Room for self-work	*Specialized furniture:* tables, chairs *Technical means of education:* computers connected to the Internet and access to an electronic information and educational environment
	214 Small reading room (196084, St. Petersburg, Chernigovskaya str., 5) Room for self-work	*Specialized furniture:* tables, chairs *Technical means of education:* computers connected to the Internet and access to an electronic information and educational environment
	324 Information Technology Department (196084, St. Petersburg, Chernigovskaya str., 5) Room for storage and preventive maintenance of educational equipment	*Specialized furniture: tables,* chairs, special equipment, materials and spare parts for preventive maintenance of technical training facilities
	Box No. 3 Carpentry workshop (196084, St. Petersburg, Chernigovsaya str., 5) Room for storage and preventive maintenance of educational equipment	*Specialized furniture: tables,* chairs, special equipment, materials and spare parts for preventive maintenance of technical training facilities

Developers:

Doctor of Biological Sciences, Professor,
Head of the Department of Biochemistry
and Physiology _____ Karpenko L.Y.

Candidate of Veterinary Sciences,
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Annex 1

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of Higher Education
«St. Petersburg State University of Veterinary Medicine»

Department of Biochemistry and Physiology

FUND OF ASSESMENT TOOLS
for the discipline
"ORGANIC, PHYSICAL AND COLLOIDAL CHEMISTRY"

Level of higher education
SPECIALIST COURSE

Specialty 05.36.01 Veterinary medicine
Full-time education.

Education starts in 2024

Saint Petersburg
2024

1. PASSPORT OF THE FUND OF ASSESMENT TOOLS

Table 1

№	Assessed modules of a discipline	Acquired competence	Assesment tool
1.	Fundamentals of physical and colloidal chemistry	UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation **UC-1_{ID-1} To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis.** GPC-4: Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.. **GPC-4_{ID-1} To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity..**	Survey, research paper, tests, review work

2.	Introduction to organic chemistry. Hydrocarbons.	UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation **UC-1$_{ID-2}$ To be able to gain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional field; search for information and solutions based on actions, experiment, experience, and information and communication technologies.** GPC-4: Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.. **GPC-4$_{ID-2}$ To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.**	Seminar, tests, review work
3.	Alcohols, phenols, aldehydes, ketones		Seminar, tests, review work
4.	Carboxylic acids		Seminar, tests, review work

5.	Lipids, carbohydrates	UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation **UC-1$_{ID-3}$ To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve problematic professional situations** GPC-4: Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. **GPC-4$_{ID-3}$** To possess skills of: the work with specialized equipment for implementation of	Seminar, tests, review work
6.	Amino acids, proteins, nucleic acids		Seminar, tests, review work

		the set tasks for research and the development of new technologies, digital ones, as well.	

List of assessment tools

Table 2

№	Typeof the evaluation tool	Short description of the evaluation tool	Presentation of an evaluation tool in the fund
1.	Seminar	A controlling tool of the educational material mastering of a topic, section or subsections of a discipline, organized as an educational activity in the form of an interview between a teacher and students	Questions on topics/sections of the discipline
2.	Test	A system of standardized tasks that allows you to automate the procedure for measuring the level of knowledge and skills of a student	The fund of test tasks
3.	Survey	A control tool organized as a special conversation between a teacher and a student on topics related to the discipline being studied, and designed to clarify the amount of knowledge of the student on a specific section, topic, problem, etc.	Questions on topics/sections of the discipline
4.	Review work	Testing the ability to apply the acquired knowledge to solve problems of a certain type on a topic or section	A set of control tasks
5.	Research paper	The result of the student's independent work, which is a written summary of the results of the theoretical analysis of a certain scientific (educational and research) topic, where the author reveals the essence of the problem under study, provides various points of view, as well as his own views on it	Topics for the research papers

INDICATORS AND CRITERIA FOR ASSESSING COMPETENCIES AT VARIOUS STAGES OF ITS FORMATION, DESCRIPTION OF ASSESSMENT SCALES

Table 3

Planned results of competency acquaired	The level of development				Assesment tool
	Unsatisfactory	Satisfactory	Good	Excellent	
UC-1 Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation					
UC-1$_{ID-1}$ To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis.	The knowledge level is below the minimum requirements and gross mistakes have been made	The minimum acceptable level of knowledge was reached, but minor mistakes have been made	The level of knowledge is in the range corresponding to the training program, with a few minor mistakes	The level of knowledge is in accordance with the training program, without mistakes	Survey, research paper, tests, review work
UC-1$_{ID-2}$ To be able to gain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional field; search for information and solutions based on actions, experiment, experience, and information and communication technologies	When solving standard tasks, basic skills were not demonstrated, and gross mistakes have been made	Basic skills have been demonstrated, typical tasks have been solved with minor mistakes, all assignments have been completed, but not to the full extent	All basic skills have been demonstrated, all basic tasks have been solved with minor errors, all tasks have been completed in full, but some with minor mistakes	All basic skills have been demonstrated, all basic tasks have been with some minor mistakes, and all tasks were completed in full extent	Seminar, tests, review work
UC-1$_{ID-3}$ To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use	When solving standard tasks, basic skills have not been demonstrated, and	There is a minimum set of skills for solving standard tasks with some minor mistakes.	All basic Skills have been demonstrated, all basic tasks were solved with	Skills have been demonstrated in solving non-standard tasks without mistakes	Seminar, tests, review work

of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve problematic professional situations.	there were gross mistakes		minor mistakes, all tasks have been completed in full extent, but some with minor mistakes		
GPC-4 Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.					
GPC-4$_{ID-1}$ To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.	The level of knowledge is below the minimum requirements, and there were gross mistakes	The minimum acceptable level of knowledge have been reached, but there were many minor mistakes	The level of knowledge is in the range corresponding to the training program with a few minor mistakes	The level of knowledge is in accordance with the training program, without mistakes	Seminar, tests, survey, review work, research paper
GPC-4$_{ID-2}$ To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained	When solving standard tasks, basic skills were not demonstrated, and there were gross mistakes	Basic skills were demonstrated, typical tasks have been solved with minor errors, all assignments were completed, but not to the full extent	All basic skills have been demonstrated, all basic tasks have been solved with minor mistakes, All tasks have been completed in full extent, but some with minor mistakes	All basic skills have been demonstrated, all main tasks were solved with minor insignificant shortcomings, and all assignments were completed in full extent	Seminar, tests, review work
GPC-4$_{ID-3}$ To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well	When solving standard tasks, basic skills have not been demonstrated, and there were gross mistakes	There is a minimum set of skills for solving standard tasks with some shortcomings	Basic skills were demonstrated in solving standard tasks with some shortcomings	Skills have been demonstrated in solving non-standard tasks without errors or shortcomings	Seminar, tests, review work

3. THE LIST OF CONTROL TASKS AND OTHER MATERIALS, NECESSARY FOR THE ASSESSMENT OF KNOWLEDGE, SKILLS AND WORK EXPERIENCE

3.1. Typical tasks to current performance assessment

3.1.1. Questions for the Seminar

Questions for evaluation the competence:

UC-1 Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation

UC-1 $_{ID-2}$ *To be able to gain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional field; search for information and solutions based on actions, experiment, experience, and information and communication technologies..*

1. The importance of carbon of organic compounds.
2. Types of hybridization of carbon atom of organic compounds.
3. Types of isomerism of organic compounds.
4. Alkanes. Characteristics of the class, nomenclature, isomerism. Obtaining alkanes.
5. Chemical properties of alkanes.
6. Alkenes. Characteristics of the class, nomenclature, structure of double bond.
7. Types of alkene isomerism.
8. Methods for the production of alkenes.
9. Chemical properties of alkenes.
10. Alkadienes. Characteristics, classification. Structure of conjugated double bond system
11. Methods of obtaining alkadienes with a conjugated double bond system.
12. Chemical properties of alkadienes with a conjugated double bond system.
13. Alkynes. Characteristics of the class, nomenclature, types of isomerism. Structure of triple bond.
14. Methods for the production of alkynes.
15. Chemical properties of alkynes.
16. Arenes. General characteristics. Structure of benzene ring.
17. Arenes. Nomenclature and isomerism.
18. Methods for the production of arenes.
19. Chemical properties of arenes.
20. Features of substitution in the benzene ring. Rule of orientation for the second substituent.

UC-1 $_{ID-3}$ *To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve problematic professional situations.*

1. Higher marginal and unsaturated fatty acids. Soaps are soluble and insoluble.
2. Triglycerides. Structure, methods of production.
3. Triglycerides. Chemical properties.
4. Phospholipids. The structure of lecithin.
5. Phospholipids. The structure of kefalin.
6. Sterols and sterides. The chemical structure of cholesterol.
7. The use of organomagnesium compounds to produce various organic compounds.
8. Pentoses. The structure of ribose, deoxyribose, xylose and arabinose.
9. Hexoses. The structure of glucose, galactose, mannose, fructose.
10. Cyclo-chain tautomerism and mutarotation of monosaccharides.
11. The concept of an asymmetric carbon atom. Mirror isomerism.
12. The structure of pyranose and furanose forms of monosaccharides on the example of glucose.
13. Cyclic forms of monosaccharides, the rules of their writing in projection and perspective forms.
14. Polyacetal hydroxyl in mono- and disaccharide molecules, its properties.
15. Chemical properties of monosaccharides.
16. Regenerating and non-regenerating disaccharides
17. Structure and characteristics of maltose.
18. The structure and characteristics of cellobiosis.
19. Structure and characteristics of lactose.
20. Structure and characteristics of sucrose.
21. Structure and characteristics of starch.
22. The structure and characteristics of glycogen.
23. The structure and characteristics of cellulose.
24. Obtaining glucose ozones.
25. Chemical properties of polysaccharides.

Questions for evaluation the competence:

GPC-4 *s able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results*

GPC-4$_{ID-2}$ *To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained*

1. Alcohols. General characteristics and classification of alcohols.
2. Marginal monatomic alcohols. The structure and properties of the hydroxygroup in the composition of alcohols. Nomenclature and isomerism.
3. Methods for obtaining limit monatomic alcohols.
4. Chemical properties of ultimate monatomic alcohols.
5. Limit diatomic alcohols. Characterization, preparation and properties.
6. Limit triatomic alcohols. Characterization, preparation and properties.
7. Phenols. Characteristics, classification, nomenclature.

8. Obtaining phenol.
9. Acidic properties of phenol. Reactions to the hydroxy group.
10. Chemical properties of phenol due to the benzene ring.
11. Oxidation of phenols, reaction to the discovery of phenols.
12. The structure of the carbonyl group and its role in organic compounds.
13. Aldehydes. Characteristics of the class. Nomenclature, isomerism.
14. Production of aldehydes.
15. Addition reactions in aldehydes and ketones.
16. Carbonyl oxygen substitution reactions in aldehydes and ketones.
17. Oxidation, polymerization and condensation reactions in aldehydes.
18. Ketones. Characteristics of the class. Obtaining ketones.
19. Carboxylic acids. General characteristics, classification. The structure of the carboxyl group.
20. Marginal monobasic and dibasic carboxylic acids. Characteristics, nomenclature, isomerism.
21. Methods for the production of limiting mono- and dicarboxylic acids.
22. Chemical properties of ultimate carboxylic acids.
23. Unsaturated carboxylic acids. Characteristics, nomenclature, isomerism. Chemical properties.
24. Hydroxycarboxylic acids. Characteristics, nomenclature, isomerism. Methods of obtaining.
25. Chemical properties of hydroxycarboxylic acids

GPC-4$_{ID-3}$ *To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well*

1. Amines. Characteristics, isomerism, methods of production.
2. Chemical properties of amines.
3. Amino acids. Structure, characteristics, nomenclature, isomerism.
4. Methods of obtaining amino acids.
5. Chemical properties of amino acids.
6. General characteristics of proteinogenic amino acids. The scheme of their structure. Interchangeable and essential amino acids.
7. Monoamine- monocarboxylic acids. Stucture.
8. Monoaminodicarboxylic and diaminomonocarboxylic acids. Stucture.
9. Cyclic amino acids. Stucture.
10. Structure of the protein molecule (primary, secondary, tertiary, quaternary structures)
11. Di- and tripeptides. Structure and nomenclature.
12. Heterocyclic compounds. General characteristics, classification.
13. The structure of the most important five-membered heterocyclic molecules.
14. The structure of the most important six-membered heterocyclic molecules.

15. Pyrimidine bases. Pyrimidine nucleotides.
16. Purine bases. Purine nucleotides
17. The structure of nucleosides.
18. Nucleic acids. Characteristics of the primary structure of RNA and DNA.
19. Nucleic acids. Characterization of the secondary structure of RNA and DNA.
20. Chromoproteins. The structure of heme.

3.1.2. Questions for the survey

Questions for evaluation the competence:

UC-1 *Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation*

UC-1 $_{ID-1}$ *To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis*

1. What is a thermodynamic system? Types of thermodynamic systems
2. The laws of thermodynamics
3. Dispersed systems – definition, classification
4. Characteristic of true dispersed systems
5. Characteristics of colloidal systems
6. Characteristics of coarse-dispersed systems
7. Aerosols, veterinary use
8. Optical properties of dispersed systems
9. The phenomenon of osmosis.
10. Osmotic pressure. The concepts of iso-, hypo-, hypertonic solutions.
11. The phenomenon of diffusion
12. Dialysis.
13. Basic concepts of chemical kinetics (chemical reaction, products, reagents, reaction mechanism)
14. Classification of chemical reactions
15. The activation energy of a chemical reaction
16. The rate of chemical reaction. Factors affecting the rate of a chemical reaction
17. Catalysis. Types of catalysis
18. Enzymatic catalysis
19. Thermal effect. Exo- and endothermic reactions
20. Theory of electrolytic dissociation
21. Characteristics of electrolytes
22. Active reaction of the environment. pH. Methods for determining pH
23. Define the concepts of acidosis and alkalosis
24. Buffer systems. Their types.

25. The mechanism of action of buffer systems.

Questions for evaluation the competence:

GPC-4 Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results

GPC-4$_{ID-1}$ *To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity*

1. Define the concept of buffer capacity.
2. Examples of blood buffer systems. What is an alkaline reserve?
3. Protein charge. The isoelectric point of the protein
4. Electrophoresis.
5. Adsorption, essence, meaning
6. Chromatography
7. Syneresis phenomena
8. The phenomenon of thixotropy
9. The structure of the colloidal micelle
10. Characteristics of sols
11. Characteristics of gels
12. Sol-gel phase transition. Gelation.
13. Features of optical properties of colloidal systems
14. Features of kinetic properties of colloidal systems
15. Sorption phenomena
16. The phenomenon of sedimentation
17. The phenomenon of protein denaturation
18. The phenomenon of coagulation
19. The phenomenon of salting out
20. Swelling phenomena

3.1.3. Tests

Tests for evaluation the competence

UC-1 Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation

UC-1$_{ID-1}$ *To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis*

1. The reaction is exothermic if...
a. the system releases heat

b. the system absorbs heat
c. there is no correct answer
d. the release or absorption of heat depends on the pH of the solution

2. The reaction will be endothermic if...
a. the system absorbs heat
b. the system releases heat
c. there is no correct answer
d. the release or absorption of heat depends on the pH of the solution

3. The section of chemical thermodynamics that studies thermal processes accompanying chemical reactions and phase transformations is
a. Thermochemistry
b. Electrochemistry
c. Theory of phase transitions

4. Entropy characterizes
a. the degree of disorder in the macrosystem
b. the degree of order in the macrosystem
c. the degree of disorder in the microsystem
d. the degree of order in the microsystem

5. The amount of heat that needs to be brought to a unit of matter in order to increase its temperature by 1 degree is
a. Heat capacity
b. Heat
c. Work
d. Enthalpy

6. Energy transfer in the form of ordered (coordinated) particle motion is
a. Work
b. Heat
c. Energy
d. Entropy

7. Energy transfer in the form of chaotic (uncoordinated) particle motion is
a. Warmth
b. Work
c. Energy
and Entropy

8. Physical chemistry studies
a. Physical phenomena in chemical systems
b. Chemical phenomena in biological systems

c. Physical phenomena in biological systems
d. Chemical phenomena in physical systems

9. The sections of thermodynamics are:
a. General thermodynamics, technical thermodynamics, chemical thermodynamics
b. General thermochemistry, technical thermodynamics, chemical thermodynamics
c. General thermodynamics, technical thermodynamics, chemical thermodynamics, mathematical thermodynamics
d. General thermochemistry, technical thermodynamics, chemical thermodynamics, physical thermodynamics

10. A thermodynamic system is
a. a body or a group of bodies that interact and are separated by a visible or imaginary interface from the environment.
b. a body or a group of bodies that interact and have no boundaries with the environment
c. a group of bodies separated from the environment by a semipermeable membrane
d. a body separated by an imaginary interface from the environment.

UC-1$_{ID-2}$ *To be able to gain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional field; search for information and solutions based on actions, experiment, experience, and information and communication technologies.*

1. Name the structure: -CH3
a. methyl
b. methane
c. ethyl
d. methene

2. Name the structure: CH4
a. methane
b. methyl
c. methene
g. pollipropylene

3. Organic chemistry studies compounds...
and. carbon
b. coal
c. hydrocarbon
d. oxygen

4. In the excited state, a carbon atom can form...
a. up to four covalent bonds

b. up to five covalent bonds
c. up to four ionic bonds
d. up to three hydrogen bonds

5. The state of the carbon atom in which the orbitals of all four valence electrons are hybridized is called...
a. sp3 hybridization
b. degree of ionization
c. the lowest degree of ionization
d. sp hybridization

6. σ-bond is read as...
a. sigma bond
b. sp3-hybridization
c. ionic bond
d. pi-bond

7. Cyclic hydrocarbons include...
a. arenas
b. alkanes
c. alkenes
d. aklins

8. Reactions characterizing the properties of alkanes DO NOT include:
a. polymerization
b. substitution
c. cleavage
d. oxidation

9. The general formula of alkanes:
a. SpN2p+2
b. SpN2p
c. SpN2p-2
g. SpN2

10. Isomers are...
a. substances of the same atomic composition, but different in structure
b. substances of the same structure, but different in atomic composition
c. substances are homologues
d. substances that are identical in physico-chemical properties, but different in atomic composition

11. The reaction of nitration of alkanes consists in ...
a. substitution of one of the hydrogen atoms with a nitro group (-NO2)

b. substitution of one of the carbon atoms with a nitro group (-NO2)
c. substitution of one of the hydrogen atoms with a nitro group (-Cl)
d. addition of a nitro group (-NO2) to one of the carbon atoms with a fifth bond

12. Dehydrogenation of alkanes leads to the formation of ...
a. all possible answers are suitable
b. Alkenov
c. Alkinov
d. arenov

13. During the oxidation of ethyl alcohol,...
a. acetic aldehyde
b. acetic ketone
c. ethanol-2
d. formic acid

14. The formation of glycerates occurs during the interaction of glycerin and ...
a. alkali metals
b. noble metals
c. propina
d. acids

15. When glycerol and nitric acid interact, the formation of ...
a. trinitroglycerin
b. dynamite
c. ethylene glycol
d. trinitroglycine occurs

16. When glycerol and carboxylic acids interact, the formation of ...
a. triglycerides
b. triglycinides
c. triforce
d. cholesterol

17. Phenols are...
a. derivatives of aromatic hydrocarbons in which one or more hydrogen atoms at the benzene ring are replaced by a hydroxogroup
b. derivatives of marginal unsaturated and saturated hydrocarbons in which one or more hydrogen atoms at carbon are replaced by a hydroxogroup
c. derivatives of aromatic hydrocarbons in which one hydrogen atom at carbon is replaced by a hydroxogroup
d. derivatives of aromatic hydrocarbons, in which one or more hydrogen atoms at the benzene ring are replaced by a carbonyl group

18. When halogenating phenol under conditions of an excess of halogen, ...
a. substitution of hydrogen atoms at the benzene ring in all three possible positions
b. substitution of hydrogen atoms at the benzene ring in ortho and para positions
c. substitution of hydrogen atoms at the benzene ring in all six positions
d. nothing happens

19. During halogenation of phenol with an equimolar ratio of reagents, ...
a. substitution of hydrogen atoms at the benzene ring in ortho- and para-positions
b. substitution of hydrogen atoms at the benzene ring in all three possible positions
c. substitution of hydrogen atoms in the benzene ring in all six positions
d. nothing happens

20. The main way to obtain phenol in the world is ...
a. cumulus method
b. fusion of benzenesulfonic acids with alkalis
c. interaction of halogen derivatives of benzene with alkalis
d. hydrolysis of fats

UC-1 $_{ID-3}$ *To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve problematic professional situations.*

1. Higher fatty acids in their composition most often have ...
a. an even number of carbon atoms
b. an odd number of carbon atoms
c. an odd number of oxygen atoms
d. an even number of hydrogen atoms

2. Marginal higher fatty acids have...
a. only single bonds in the hydrocarbon radical
b. only double bonds in the hydrocarbon radical
c. at least one double or triple bond in the carbon radical
d. at least two triple bonds in the carbon radical

3. Unsaturated higher fatty acids have...
a. at least one double in the carbon radical
b. only single bonds in the hydrocarbon radical
c. only double bonds in the hydrocarbon radical
d. at least two triple bonds in the carbon radical

4. Which higher fatty acid has 4 multiple bonds in the chain...
a. Arachidonic acid

b. Palmitic acid
c. Oleic acid
d. Stearic acid

5. Which higher fatty acid does not have multiple bonds in the carbon chain?
a. Arachinic acid
b. Erucic acid
c. α-Linolenic acid
d. Arachidonic

6. Which higher fatty acid does not have multiple bonds in the carbon chain?
a. Stearic acid
b. Arachidonic acid
c. Oleic acid
d. Linoleic acid

7. The main method of obtaining fatty acids is...
a. hydrolysis of triglycerides
b. hydrolysis of HCL
c. hydrolysis of alkalis to acid residues and hydroxogroups
d. acetate wrinkling of carbohydrates

8. Fatty acids with glycerin or cholesterol form...
a. esters
b. conglomerate
c. salts and semi-acetals
d. polymers

9. Salts of higher fatty acids are called...
a. soaps
b. gels
c. colloids
d. shampoos

10. To obtain a fatty acid salt, the interaction of fatty acid and ...
a. alkali
b. acid is necessary
c. other mineral salt
d. inert gas or noble metal

11. The formation of anhydrides occurs when ...
a. the carbonyl group of one carboxylic acid interacts with the hydroxyl group of another carboxylic acid or within one dicarboxylic acid
b. carboxylic acids with ammonia through an intermediate product -

ammonium salt

c. hydroxyl groups of carboxylic acid and alcohol to form acidic and medium esters

d. carboxylic acids and phosphorus chloride

12. The formation of halogenanhydrides occurs during the interaction of ...

a. carboxylic acids and phosphorus chloride

b. a carbonyl group of one carboxylic acid with a hydroxyl group of another carboxylic acid or inside one dicarboxylic acid

c. carboxylic acids with ammonia through an intermediate product - ammonium salt

d. hydroxyl groups of carboxylic acid and alcohol to form acidic and medium esters

13. During the esterification reaction, the interaction of ...

a. hydroxyl groups of carboxylic acid and alcohol occurs with the formation of acidic and medium esters

b. carboxylic acids and phosphorus chloride

c. a carbonyl group of one carboxylic acid with a hydroxyl group of another carboxylic acid or within one dicarboxylic acid

d. carboxylic acids with ammonia through an intermediate product - ammonium salt

14. During the formation of amides, the interaction occurs ...

a. carboxylic acids with ammonia through an intermediate product - ammonium salt

b. hydroxyl groups of carboxylic acid and alcohol with the formation of acidic and medium esters

c. carboxylic acids and phosphorus chloride

d. carbonyl group of one carboxylic acid with a hydroxyl group of another carboxylic acid or within one dicarboxylic acid

15. Name the substance that does not participate and is not formed in this reaction:

$C_{17}H_{35}-COOH + NaOH \rightarrow C_{17}H_{35}-COONa + H_2O$

a. sodium oleate

b. stearic acid

c. sodium hydroxide

d. sodium stearate

16. Select a substance that does not participate and is not formed in this reaction:

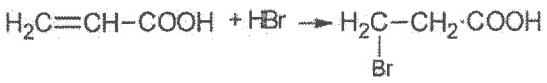
$HC\equiv CH + H-C\equiv N \rightarrow H_2C=CH-C\equiv N$

a. water

b. acetylene

c. prussic acid
d. acrylonitrile

17. Select a substance that does not participate and is not formed in this reaction:

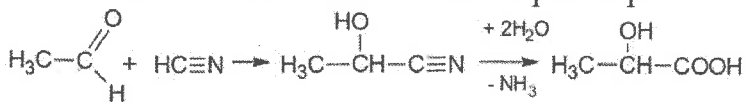


a. water
b. acrylic acid
c. hydrogen bromide
d. 3-bromopropanoic acid

18. Select a substance that does not participate and is not formed in this reaction:

a. potassium hydroxide
b. vinylacetic acid
c. sodium hydroxide
d. sodium vinyl acetate

19. Select a substance that does not participate and is not formed in this reaction:



a. acetic acid
b. acetic aldehyde
c. hydrocyanic acid
d. hydroxynitrile

20. The main physical property of lipids is ...
a. hydrophobicity (the desire to "avoid" contact with water)
b. hydrophilicity (a good degree of interaction with water)
c. hydroneutrality (neutral attitude to water)
G. hydropericarditis (accumulation of fluid in the pericardial cavity)

Tests for evaluation the competence

GPC-4 Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results

GPC-4$_{ID-1}$ To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

1. The aggregate state of the dispersion medium for suspension
    a. Liquid
    b. Solid
    c. Gaseous
    d. There is no correct answer

2. The aggregate state of the dispersed phase for aerosols
    a. Liquid
    b. Solid
    c. Gaseous
    d. There is no correct answer

3. The negative decimal logarithm of the concentration of hydrogen ions is
    a. pH
    b. electrical conductivity
    c. buffer capacity
    d. osmosis

4. The digital pH scale is in the range
    a. 0-14
    b. 0-24
    c. 0-100
    d. 7-17

2. The ability of substances to conduct electric current under the influence of an external electric field. – This is
    a. Electrical conductivity
    b. Resistance
    c. Electrophoresis
    d. Pyrolysis

3. Which blood buffer system does not exist?
    a. Acetate buffer system
    b. Bicarbonate buffer system
    c. Phosphate buffer system
    d. G. Protein buffer system

4. How many buffer systems do we have in blood plasma?
a) 4
b) 5
c) 1
d) 10

5. Acidic buffer systems consist of
    a. weak acid and its salt
    b. weak base and its salt
    c. one- and two-substituted salts of polybasic acids
    d. glucopyranose and glucofuranose

6. The main buffer systems consist of
    a. weak base and its salt
    b. weak acid and its salt
    c. one- and two-substituted salts of polybasic acids
    d. glucopyranoses and glucofuranoses

7. Solutions that have the property of steadfastly maintaining constancy (pH) when adding a certain amount of strong acids or alkalis to them, as well as when diluted are
    a. Buffer solutions
    b. Solutions with a certain temperature
    c. Glucose solutions
    d. Isotonic sodium chloride solution

GPC-4$_{ID-2}$ To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained

1. Which of the listed substances has a conjugated arrangement of double bonds?
    a) pentadiene-1,3
    b) butadiene-1,2
    c) propadiene-1,2
    d) pentadiene-1,4

2. Which of the listed substances has a cumulative arrangement of double bonds?
    a. pentadiene-2,3
    b. butadiene-1,3
    c. propane
    d. g. pentadiene-1,4

3. In the benzene molecule, the bonds have...
    a. conjugate arrangement
    b. isolated arrangement
    c. stressed arrangement
    d. cumulative arrangement

4. The hydration reaction of alkenes is ...
    a. and. connection of water at the place of double connection
    b. b. the addition of hydrogen at the site of the double bond
    c. c. the formation of CO2 and H2O
    d. d. the transition of hybridization levels to a more energetically advantageous

level

5. The hydrogenation reaction of alkynes is ...
   a. and. the addition of hydrogen at the site of the triple bond
   b. b. the addition of water at the site of the triple bond
   c. c. the formation of CO2 and H2O
   d. d. the transition of hybridization levels to a more energetically advantageous level

6. During the combustion reaction of hydrocarbons, the formation of ...

   a. CO2 and H2O
   b. CO2 and H2
   c. low-carbon compounds
   d. low-density carboxylic acids

6. Which of the above is NOT a possible product of the glycerol oxidation reaction?
   a. glycine
   b. glycerol aldehyde
   c. dioxyacetone
   d. glycerol acid

7. During the reaction of obtaining glycerol from propylene, one of the conditions is ...
   a. heating to 450oC
   b. cooling to -450oC
   c. exclusion of peroxides
   d. presence of sulfuric acid

8. The orientants of the first order include:
   a. Cl
   b. NO2
   c. SO3H
   d. COOH

9. Orientants of the second order include:
   a. SO3H
   b. OH
   c. CH3
   d. Cl

10. Orientants of the second order include:
   a. COOH
   b. OH
   c. CH3

d. Cl

11. The carbonyl group is...
    a. a compound of carbon with oxygen by a double bond
    b. a compound of hydrogen with oxygen by a double bond
    c. a compound of carbon with oxygen by a single bond
    d. a compound of carbon with oxygen by a double bond and with a hydroxyl group

12. In aldehydes, the carbonyl group is located...
    a. always in the extreme position
    b. sometimes in the extreme position, sometimes in the central
    c. position c. always not in the extreme position
    d. never in the extreme position

13. In ketones, the carbonyl group is located...
    a. Always not in an extreme position
    b. sometimes in the extreme position, sometimes in the central
    c. position. always in the extreme position
    d. . sometimes in the extreme position

14. The formula CnH2nO is common for ...
    a. limiting aldehydes and ketones
    b. only limiting aldehydes
    c. only limiting ketones
    d. unsaturated aldehydes and ketones

15. Select pairs of isomers or identical names of the same substance:
    a. Acetone - Propionic aldehyde
    b. Formaldehyde – Methanal
    c. Oil aldehyde – Butanone-2
    d. G. Valerian aldehyde – 3-methylbutanal

16. To obtain aldehyde during the alkyne hydration reaction, it is necessary to use ...
    a. Ethane
    b. butine-2
    c. propine
    d. g. phenol as a reagent

17. To obtain acetone during the hydration reaction of alkynes, it is necessary to use as a reagent ...
    a. Propine
    b. ethane
    c. butin-1

d. butin-2

18. To obtain acetic aldehyde during the oxidation reaction of alcohols, it is necessary to use as a reagent ...
a. ethyl alcohol
b. methyl alcohol
c. propanol-1
d. propanol-2

19. To obtain acetone during the oxidation reaction of alcohols, it is necessary to use ...
a. propanol-2 as a reagent
b. ethyl alcohol
c. methyl alcohol
d. propanol-1

GPC-4$_{ID-3}$ *To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well*

1. Simple lipids do not include:
a. polysaccharides
b. sterols
c. triglycerides
d. higher alcohols

2. Simple lipids include (several possible answers):
a. triglycerides
b. phospholipids
c. lipases
d. lipomas

3. The composition of glycerophospholipid does NOT include ...
a. glycine
b. glycerin
c. fatty acid residues
d. phosphoric acid residue

4. The composition of amino alcohols, in addition to carbon, hydrogen and oxygen, includes ...
a. nitrogen
b. amine
c. amino
acid d. alcohol

5. The esterification reaction of glycerol and fatty acids at a temperature of 200 ° C is called...
a. Berthelot synthesis
b. Wurtz synthesis
B. synthesis of the Beatles
G. resynthesis of hydrolyzed lipids

6. When triglycerides and sodium hydroxide interact, the formation of ...
a. soap
b. free fatty acids
c. glycine
d. all the listed options are correct

7. During hydrogenation of triglycerides, ...
a. formation of saturated fatty acid residues from unsaturated
b. formation of unsaturated fatty acid residues from saturated
c. production of liquid soap
d. dilution of solid soap

8. Rancidity is...
a. oxidation of fats under the action of oxygen
b. oxidation of oils in the light, especially with linoleic acid content
c. oxidation of carbohydrates under the action of oxygen
d. addition of halogens in order to determine the iodine number of fat

9. Rancidity is most pronounced ...
and. a change in taste and smell
b. a change in color and solubility
c. a change in melting point
d. a change in consistency

10. From the listed substances, select carbohydrates related to hexoses (there are several possible answers):
a. glucose
b. glycogen
c. albumin
d. deoxyribose

11. Which of the carbohydrates belongs to the pentoses?
a. ribose
b. sucrose
c. maltose
d. lactose

12. Which of the carbohydrates belongs to pentoses?
a. ribose
b. arabinose
c. lactose
d. glucose

13. Which of the carbohydrates is a polysaccharide?
a. starch
b. ribose
c. galactose
d. fructose

14. From the listed substances, select monosaccharides
a. deoxyribose
b. sucrose
c. maltose
d. lactose

15. From the listed substances, select monosaccharides
a. glucose
b. starch
c. sucrose
d. aldolase

16. Ozazone molecules have...
a. yellow staining
b. blue staining
c. white staining
d. pink staining

17. Which of the above does not apply to heterocyclic compounds?
a. methane
b. furan
c. pyrrol
d. pyridine

18. Which of the above does not apply to heterocyclic compounds?
a. tristearin
b. nicotinamide
c. heme
d. purine

19. Which of the above does not apply to heterocyclic compounds?
a. alanine

b. adenine
c. guanine
d. thymine

20. Nucleic acids include...
a. DNA
b. PVC
c. ribose
d. thiamine

3.1.4. Topics of the research papers

Topics of the research papers to evaluate the competence:

UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation

UC-1 $_{ID-1}$ *To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis.*

1. The importance of physical and colloidal chemistry for agriculture.
2. The importance of colloidal systems in the functioning of the cell and the whole organism.
3. Osmosis, osmotic pressure in the performance of functions of a living organism in normal and pathological conditions.
4. Diffusion and its importance in metabolism and functioning of a living organism.
5. Buffer systems. The main characteristics and properties. Mechanism of action and biological significance.
6. Surfactants, their biological significance.
7. Modern concepts of the structure of the dispersed phase of the colloidal system and the IUD.
8. Basic properties of hydrophobic colloidal systems.
9. The main properties of the IUD.
10. Soil colloids. Methods of studying soil colloids and minerals.
11. Modern ideas about the theory of solutions and the dissolution process.
12. True solutions. Basic properties and meaning.
13. Brownian motion. The essence and significance for the functioning of a living organism.
14. Sorption phenomena in nature.
15. Comparative characteristics of the optical properties of dispersed systems. Diagnostic and therapeutic techniques using these characteristics.
16. Comparative characteristics of kinetic properties of dispersed systems. Diagnostic and therapeutic techniques using these characteristics.
17. Dependence of the main characteristics of dispersed systems on the particle size of

the dispersed phase.

18. General characteristics of protein solutions. Protein systems of the body.

19. Surface phenomena as properties of dispersed systems. The biological significance of surface phenomena.

20. Chlorophyll research.

GPC-4 Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results

GPC-4$_{ID-1}$ To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

1. Chromatography – the essence of the method, application and meaning.
2. Electrophoresis – the essence of the method, application and meaning.
3. The main properties of proteins and their importance in the vital activity of the body.
4. Comparative characteristics of the basic properties of dispersed systems. Diagnostic and therapeutic techniques using these characteristics.
5. The biological significance of the states of colloidal systems – sol and gel. The essence and mechanism of aging of colloidal systems.
6. Active reaction of the environment. Biological significance and methods of determination.
7. Thermochemistry. Basic laws and consequences in biology.
8. Thermodynamics in the existence of biological systems.
9. Catalysis. Its importance of catalysis in biology, industry, and agricultural production.
10. Plasma is the fourth aggregate state of matter.
11. Cryoscopy. Ebullioscopy.
12. Electrochemistry. The history of development and basic laws.
13. Common and distinctive properties of IUDs with true solutions and colloidal systems.
14. The phenomenon of coagulation and its significance. The phenomenon of coacervation.
15. The phenomenon of hydration. The essence and meaning.
16. The phenomenon of swelling. The essence and meaning.
17. Salting, essence and application.
18. The phenomenon of denaturation, its essence and meaning.
19. The phenomenon of dialysis, its essence and application.
20. Oncotic pressure, the essence and meaning.
21. Donnan's membrane equilibrium and its significance.
22. Colloidal protection, essence and application.
23. The using of protein solutions in medicine and veterinary medicin

4.1.5 Questions for review works

Control questions for evaluation the competence:

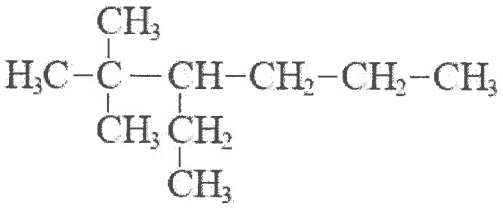
UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation

UC-1$_{ID-1}$ To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis

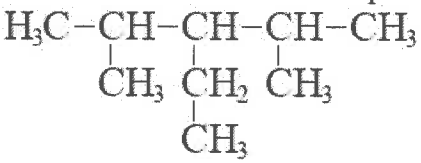
1. What is a "thermodynamic system"? What types of thermodynamic systems are divided into (according to the degree of complexity, according to the nature of interaction with the environment)?
2. What is called a "thermodynamic parameter"? Types of thermodynamic parameters?
3. Give examples of extensive and intensive parameters of the state of a thermodynamic system. How does an intensive state parameter differ from an extensive one?
4. What is a "thermodynamic process"? What types of processes are distinguished in thermodynamics?
5. The first law of thermodynamics. What is "enthalpy", what is this state function used for?
6. Formulate the second law of thermodynamics. What is "entropy"
7. Formulate the third law of thermodynamics (in the form of Planck's postulate).
8. Formulate Hess's law and its consequences, indicate what they are used for in practice.
9. What are dispersed systems? Types of dispersed systems
10. Characteristics of the properties of true solutions
11. Characteristics of the properties of coarse-grained solutions
12. Characteristics of the properties of colloidal solutions

***UC-1$_{ID-2}$** To be able to gain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional field; search for information and solutions based on actions, experiment, experience, and information and communication technologies.*

1. Write the formulas of all hexane isomers, sign the names according to the systematic nomenclature.
2. Write the formulas of all heptane isomers, sign the names according to the systematic nomenclature.
3. Obtain by the Wurtz reaction
 a) butane;
 b) 2,3-dimethylbutane.
4. Name the connection by IUPAC:



5. Write the reaction of propane with nitric acid.
6. Write the formula for the following hydrocarbon: 2,2,4-trimethyl, 3-ethylhexane.
7. Write the reaction of isobutane with chlorine.
8. Obtain pentane and 2-methylbutane by the Wurtz reaction.
9. Name the compound according to the systematic nomenclature:



Circle all the secondary carbon atoms.

10. Write the formula for the following hydrocarbon: 2,2,3,4-tetramethyl 3,4-diethylheptan. Circle all the primary carbon atoms.
11. Write the interaction of propane with Br2 and HNO3, as well as the dehydrogenation and thermal decomposition of propane.
12. Write the reaction of the interaction of metallic sodium with two molecules of 2-chlorobutane. Name the product.
13. Write the isomers of hexene and name them according to the international nomenclature.
14. Obtain propene in three ways and write reactions with it:
    a) with HCl b) with Br2
15. Methods for obtaining alkenes using the example of ethene.
16. Alkadienes. Brief description, classification, isomerism.
17. Methods for the production of alkadienes with a conjugated double bond system.
18. Obtain acetylene in all possible ways and write reactions with it: dimerization and trimerization.
19. Obtain propene in three ways and write reactions with it:
    a) with HBr
    b) with HOH
    c) with Cl2.
    Specify the reaction products.
20. Write hexine isomers, name them according to the International Nomenclature.
21. Write the reactions:
    a) acetylene oxidation
    b) the Kucherov reaction (acetylene + H2O)
    c) the formation of silver acetylenide.
22. Write the reactions of addition of H2 and Br2 to butadiene-1,3.
23. The structure of benzene. Homologues of benzene. Isomerism of benzene homologues.
24. Methods of obtaining benzene. Write the nitration reaction of benzene.

25. To obtain toluene by the Wurtz-Fittig and Friedel-Kraftz method.
26. The substitution rule in the benzene ring. Orientants of the I and II order. Give examples.
27. Write the reactions and specify the reaction products:
    a) benzene + 3Cl2 →
    b) toluene + Br2 →
    c) xylene oxidation
28. Write the structural formulas: meta-dimethylbenzene and para-methylethylbenzene.
29. Based on benzene, get ortho- and meta- bromonitrobenzenes.
30. Write the reactions:
31. a) hydrogenation of benzene
32. b) oxidation of toluene
33. Perform the following transformations: acetylene → benzene → chlorobenzene → toluene.
34. Write the nitration reactions of toluene and nitrobenzene.
35. Write the formulas of primary, secondary and tertiary alcohol with the gross formula C4H9H. To name them according to the international nomenclature.
36. Write the main methods for obtaining alcohols using the example of propanol-1.
37. Obtain alcohol propanol-2 and write reactions with it:
    a) with CH3COOH
    b) with PCl3
    Name the reaction products.
38. Obtain butanol-1 and write with it the reaction of the formation of an ester with acetic acid.
39. Obtain ethylene glycol from ethylene and write the reaction of two molecules with copper hydroxyl – Cu(OH)2. Name the reaction product.
40. Obtain glycerin in any way and write the reaction of its nitration.
41. Write the reaction of formation of copper glycerate.
42. To obtain butanol-1 by the Grignard reaction and write reactions with it:
    a) with C_2H_5OH
    б) with CH_3-CH_2COOH

UC-1 *ID-3 To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve problematic professional situations.*

1. Methods of obtaining triglycerides.
2. Which higher fatty acids are included in fats? Write down the formulas of the most important marginal and unsaturated higher fatty acids.
3. Hydrogenation of fats. Oxidation of fats.
4. Formation of soaps insoluble in water. The reaction of lead soap, calcium soap.

5. Write the saponification reaction of tripalmitine with an alcoholic solution of NaOH.
6. Write the formula of serine phosphatide.
7. Write the lecithin formula.
8. Write the kefeain formula.
9. Write the formula of cholesterol and its ester with palmitic acid.
10. Write the formulas of fructose, galactose and mannose in the chain form of the D-optical series.
11. Write the formulas of ribose, xylose, arabinose in the chain form of the D-optical series.
12. Write the formulas of D-glucose, α-glucopyranose and α-glucofuranose.
13. Write the reactions of oxidation and reduction of galactose.
14. The structure of D and L-fructose, β-fructofuranose.
15. What is cyclo-chain tautomerism of sugars? Use glucose as an example.
16. Write the reactions of the interaction of α-glucopyranose with Ca(OH)2 and CH3I.
17. Get the glucose ozazone.
18. Write the formulas of D- and L-arabinose. Write the oxidation reaction of D-arabinose.
19. Characteristics of disaccharides. What is the glycoside bond, reducing and non-reducing sugars?
20. The structure of maltose. Hydrolysis of maltose.
21. The structure of lactose. Lactose hydrolysis.
22. The structure of sucrose. Hydrolysis of sucrose.
23. The structure of cellobiosis. Hydrolysis of cellobiose.
24. The structure of starch (amylose, amylopectin).
25. The structure of cellulose. Nitration of cellulose.
26. The structure of glycogen. The difference in structure from starch

Control questions for evaluation the competence:

GPC-4 Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results

GPC-4$_{ID-1}$ *To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.*

1. Define the concepts of chemical reaction, reagents, reaction products, reaction mechanism
2. Characteristics of chemical reactions
3. The rate of chemical reaction
4. Dependence of the rate of a chemical reaction on temperature
5. Dependence of the chemical reaction rate on pH
6. Dependence of the rate of a chemical reaction on the concentration of reacting

substances
7. Dependence of the rate of chemical reaction on the presence of foreign substances in the system
8. Catalysis. The main types of catalysis
9. Catalysts. Mechanism of action
10. Factors influencing catalysis
11. Theory of electrolytic dissociation.
12. Electrical conductivity. Features of electrical conductivity of biological systems.
13. Active reaction of solutions.
14. The concept of the hydrogen index. Methods for determining pH
15. Define alkalosis and acidosis
16. Buffer systems – definition, classification by chemical composition. The mechanism of action of buffer systems
17. Buffer capacity. Buffer systems of animal blood
18. Main types of colloids: characteristics of gels
19. Main types of colloids: characteristics of sols
20. Properties of colloidal systems: optical properties
21. Properties of colloidal systems: kinetic properties
22. Properties of colloidal systems: electrical properties
23. Surface phenomena in colloidal systems
24. Sorption phenomena in colloidal systems
25. Stability and coagulation of colloidal systems
26. General characteristics of the HSR. Types of IUDs by origin.
27. Characteristics and examples of each type
28. Swelling and dissolution of the IUD.
29. Aging of IUD solutions

GPC-4$_{ID-2}$ To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained

1. Write the reactions:
   a) pentanol-3 [O]→
   b) propanol-2 + Na →
   c) ethanol + CH3COOH →
   Name the reaction products.
2. Obtain ethanediol-1,2 in two ways and write the intermolecular dehydration reaction.
3. Obtain phenol from the cumulus method.
4. Write the formulas of ortho-, meta-, para-cresols.
5. Write the reactions of nitration and bromination of phenol.
6. Write the reactions of interaction of phenol with NaOH and FeCl3
7. Write the reaction of obtaining picric acid. Which reaction reveals the presence of phenols?
8. Write the reactions of the formation of esters and esters:

a) from phenolates and haloalkyl.
b) from phenolates with halogenanhydrides.

9. Write the reactions for the production of aldehydes.
10. Write the reactions of:
    a) methanal with hydrogen;
    b) formaldehyde with hydroxylamine;
11. Obtain the semi-acetal and acetal of the oil aldehyde.
12. To obtain formic aldehyde from methanol. Show the silver mirror reaction with the resulting formaldehyde.
13.. Get aldehydes during the oxidation of alcohols, from acid chlorohydrides.
14. Get acetone from alkynes, salts of carboxylic acids, secondary alcohols.
15. 1 Write the reaction of acetone:
    a) with hydrazine;
    b) with phosphorus pentachloride;
    c) with prussic acid.
16. Write the reactions of aldol and croton condensation of an oil aldehyde.
17. Write the oxidation reactions of butanal and butanone-2.
18. Obtain butyric acid from alcohol and by hydrolysis of nitriles.
19. To obtain propionic acid by the Grignard method.
20. Get acetic acid in any way and write reactions with: a) phosphorus trichloride; b) bromine.
21. Get anhydride and propionic acid halide
22. Write down the reactions when oxalic and succinic acids are heated.
23. Get the anhydrides of succinic and glutaric acids.
24. Get acetic acid from acetylene. Then get an ester from acetic acid.
25. Cis- and trans- isomerism of butenedioic acid. What is the difference in the chemical properties of fumaric and maleic acids?
26. Production of monobasic limit carboxylic acids. The reaction of acrylic acid with HCl and NH3.
27. Types of hydroxy acid isomerism on the example of lactic acid.
28. Reactions of water withdrawal from α, β, γ-hydroxyacids.
29. Keto-enol tautomerism of ketoacids. Reaction of ketoacids with hydrazine (using the example of PVC).
30. Methods for obtaining hydroxyacids.
31. The reaction of acetone formation from β–hydroxybutyric acid.
32. Methods for obtaining unsaturated carboxylic acids.
33. Write the oxidation reactions of formic and butyric acids.

GPC-4$_{ID-3}$ *To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.*

1. Amino acids – structure, classification.
2. Methods of obtaining amino acids.
3. Monoaminomonocarboxylic acids. Write the dipeptide serylhistidine.

4. Monoaminodicarboxylic acids. Write a tripeptide of lysine, alanine and glycine and name it.
5. Diaminocarboxylic amino acids. Write tripeptide: threonylvalylthyrosine.
6. Write amino acids containing sulfur. Write the reaction of one of these acids with PCl5.
7. Write the formulas of cyclic amino acids.
8. Write the amino acid formulas containing the aromatic cycle.
9. Obtain a tripeptide from serine, methionine, and arginine.
10. Obtaining amino acids by the cyanhydrin method and by reducing α–nitroacids.
11. Monobasic diaminoacids. Write the reactions of the formation of halides and amino acid esters.
12. Hydroxyaminoacids. Write down their formulas and the dipeptide serylalanine.
13. Amino acids containing sulfur. Write a tripeptide: methionylthyrosylarginine.
14. The structure of purine and its derivatives – purine nitrogenous bases. Write the nucleoside adenosine.
15. The structure of heme.
16. The structure of condensed heterocycles – indole, skatole, purine, uric acid.
17. The structure of pyrimidine and its derivatives – pyrimidine nitrogenous bases. Write the formula of uridine monophosphate.
18. Write the formulas of the most important five-membered heterocycles (at least five). Sign the names.
19. Write the nitrogenous bases that make up the RNA.
20. Write the formulas of the most important six-membered heterocycles. Sign the names.
21. Write the formulas of guanine and cytosine. Write the formula of thymidylic acid.
22. Write the nitrogenous bases that make up DNA.

After studying the course of organic chemistry using all the necessary teaching materials (educational literature, presentations and other materials in an electronic environment), the student must complete a review work.

The answers to the questions of the control task must correspond to their own version. There are 10 options in total, each option has 16 questions. The completed version of the control task is determined by the last digit of the record book number. For example, if the number is 97301, then in this case the student performs the first option (questions №№1, 11, 21, 31, 41, 51, 61, 71, 81, 91, 101, 111, 121, 131, 141, 151). The question numbers for each option are shown in the table:

Option number	The numbers of questions related to this assignment option															
1	1	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151
2	2	12	22	32	42	52	62	72	82	92	102	112	122	132	142	152

3	3	13	23	33	43	53	63	73	83	93	103	113	123	133	143	153
4	4	14	24	34	44	54	64	74	84	94	104	114	124	134	144	154
5	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155
6	6	16	26	36	46	56	66	76	86	96	106	116	126	136	146	156
7	7	17	27	37	47	57	67	77	87	97	107	117	127	137	147	157
8	8	18	28	38	48	58	68	78	88	98	108	118	128	138	148	158
9	9	19	29	39	49	59	69	79	89	99	109	119	129	139	149	159
0	0	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

3.2. Typical tasks for intermediate certification

3.2.1. Questions for exam

UC-1: Is able to carry out a critical analysis of problematic situations based on a systematic approach, to develop a strategy for manipulation

UC-1$_{ID-1}$ To know methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis

1. What is a thermodynamic system? Types of thermodynamic systems
2. The laws of thermodynamics
3. Dispersed systems – definition, classification
4. Characteristic of true dispersed systems
5. Characteristics of colloidal systems
6. Characteristics of coarse-dispersed systems
7. Aerosols, veterinary use
8. Optical properties of dispersed systems
9. The phenomenon of osmosis.
10. Osmotic pressure. The concepts of iso-, hypo-, hypertonic solutions.
11. The phenomenon of diffusion
12. Dialysis.
13. Basic concepts of chemical kinetics (chemical reaction, products, reagents, reaction mechanism)
14. Classification of chemical reactions
15. The activation energy of a chemical reaction
16. The rate of chemical reaction. Factors affecting the rate of a chemical reaction
17. Catalysis. Types of catalysis
18. Enzymatic catalysis

19. Thermal effect. Exo- and endothermic reactions
20. Theory of electrolytic dissociation
21. Characteristics of electrolytes
22. Active reaction of the environment. pH. Methods for determining pH
23. Define the concepts of acidosis and alkalosis
24. Buffer systems. Their types.
25. The mechanism of action of buffer systems.

UC-1 $_{ID-2}$ *To be able to gain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems, related to the professional field; search for information and solutions based on actions, experiment, experience, and information and communication technologies.*

1. The value of carbon in organic compounds.
2. Types of hybridization of the carbon atom in the composition of organic compounds.
3. Types of isomerism in organic compounds
4. Alkanes. Class characteristics, nomenclature, isomerism. Production of alkanes.
5. Chemical properties of alkanes.
6. Alkenes. Class characteristics, nomenclature, double bond structure.
7. Types of alkene isomerism.
8. Methods for the production of alkenes.
9. Chemical properties of alkenes.
10. Alkadienes. Characteristics, classification. The structure of the conjugate system of double bonds.
11. Methods for the production of alkadienes with a system of conjugated double bonds.
12. Chemical properties of alkadienes with a system of conjugated double bonds.
13. Alkynes. Class characteristics, nomenclature, types of isomerism. The structure of the triple bond.
14. Production of alkynes.
15. Chemical properties of alkynes.
16. Arenas. General characteristics. The structure of the benzene ring.
17. Arenas. Nomenclature and isomerism.
18. Getting arenas.
19. Chemical properties of arenes.
20. Features of substitution in the benzene ring. The rule of orientation of the second substituent.

UC-1 $_{ID-3}$ *To possess skills of evaluation of the problem of professional activity with the analyze of synthesis and other methods of intellectual activity, including the use of information and communication technologies; identification of problems and the use of adequate methods to solve them; demonstration of value judgments to solve*

problematic professional situations.

1. Higher marginal and unsaturated fatty acids. Soaps are soluble and insoluble.
2. Triglycerides. Structure, methods of production.
3. Triglycerides. Chemical properties.
4. Phospholipids. The structure of lecithin.
5. Phospholipids. The structure of kefalin.
6. Sterols and sterides. The chemical structure of cholesterol.
7. The use of organomagnesium compounds to produce various organic compounds.
8. Pentoses. The structure of ribose, deoxyribose, xylose and arabinose.
9. Hexoses. The structure of glucose, galactose, mannose, fructose.
10. Cyclo-chain tautomerism and mutarotation of monosaccharides.
11. The concept of an asymmetric carbon atom. Mirror isomerism.
12. The structure of pyranose and furanose forms of monosaccharides on the example of glucose.
13. Cyclic forms of monosaccharides, the rules of their writing in projection and perspective forms.
14. Polyacetal hydroxyl in mono- and disaccharide molecules, its properties.
15. Chemical properties of monosaccharides.
16. Regenerating and non-regenerating disaccharides
17. Structure and characteristics of maltose.
18. The structure and characteristics of cellobiosis.
19. Structure and characteristics of lactose.
20. Structure and characteristics of sucrose.
21. Structure and characteristics of starch.
22. The structure and characteristics of glycogen.
23. The structure and characteristics of cellulose.
24. Obtaining glucose ozones.
25. Chemical properties of polysaccharides.

Questions for evaluation the competence:

GPC-4 Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

1. Define the concept of buffer capacity.
2. Examples of blood buffer systems. What is an alkaline reserve?
3. Protein charge. The isoelectric point of the protein
4. Electrophoresis.
5. Adsorption, essence, meaning

6. Chromatography
7. Syneresis phenomena
8. The phenomenon of thixotropy
9. The structure of the colloidal micelle
10. Characteristics of sols
11. Characteristics of gels
12. Sol-gel phase transition. Gelation.
13. Features of optical properties of colloidal systems
14. Features of kinetic properties of colloidal systems
15. Sorption phenomena
16. The phenomenon of sedimentation
17. The phenomenon of protein denaturation
18. The phenomenon of coagulation
19. The phenomenon of salting out
20. Swelling phenomena

GPC-4$_{ID-2}$ To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained

1. Alcohols. General characteristics and classification of alcohols.
2. Marginal monatomic alcohols. The structure and properties of the hydroxygroup in the composition of alcohols. Nomenclature and isomerism.
3. Methods for obtaining limit monatomic alcohols.
4. Chemical properties of ultimate monatomic alcohols.
5. Limit diatomic alcohols. Characterization, preparation and properties.
6. Limit triatomic alcohols. Characterization, preparation and properties.
7. Phenols. Characteristics, classification, nomenclature.
8. Obtaining phenol.
9. Acidic properties of phenol. Reactions to the hydroxy group.
10. Chemical properties of phenol due to the benzene ring.
11. Oxidation of phenols, reaction to the discovery of phenols.
12. The structure of the carbonyl group and its role in organic compounds.
13. Aldehydes. Characteristics of the class. Nomenclature, isomerism.
14. Production of aldehydes.
15. Addition reactions in aldehydes and ketones.
16. Carbonyl oxygen substitution reactions in aldehydes and ketones.
17. Oxidation, polymerization and condensation reactions in aldehydes.
18. Ketones. Characteristics of the class. Obtaining ketones.
19. Carboxylic acids. General characteristics, classification. The structure of the carboxyl group.
20. Marginal monobasic and dibasic carboxylic acids. Characteristics, nomenclature, isomerism.
21. Methods for the production of limiting mono- and dicarboxylic acids.
22. Chemical properties of ultimate carboxylic acids.
23. Unsaturated carboxylic acids. Characteristics, nomenclature, isomerism. Chemical properties.

24. Hydroxycarboxylic acids. Characteristics, nomenclature, isomerism. Methods of obtaining.
25. Chemical properties of hydroxycarboxylic acids.

GPC-4$_{ID-3}$ To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

1. Amines. Characteristics, isomerism, methods of production.
2. Chemical properties of amines.
3. Amino acids. Structure, characteristics, nomenclature, isomerism.
4. Methods of obtaining amino acids.
5. Chemical properties of amino acids.
6. General characteristics of proteinogenic amino acids. The scheme of their structure. Interchangeable and essential amino acids.
7. Monoamine- monocarboxylic acids. Building.
8. Monoaminodicarboxylic and diaminomonocarboxylic acids. Building.
9. Cyclic amino acids. Building.
10. Structure of the protein molecule (primary, secondary, tertiary, quaternary structures)
11. Di- and tripeptides. Structure and nomenclature.
12. Heterocyclic compounds. General characteristics, classification.
13. The structure of the most important five-membered heterocyclic molecules.
14. The structure of the most important six-membered heterocyclic molecules.
15. Pyrimidine bases. Pyrimidine nucleotides.
16. Purine bases. Purine nucleotides
17. The structure of nucleosides.
18. Nucleic acids. Characteristics of the primary structure of RNA and DNA.
19. Nucleic acids. Characterization of the secondary structure of RNA and DNA.
20. Chromoproteins. The structure of heme.

4. METHODOLOGICAL MATERIALS DEFINING THE PROCEDURES FOR ASSESSING KNOWLEDGE, SKILLS AND ABILITIES AND WORK EXPERIENCE CHARACTERIZING THE STAGES OF COMPETENCE FORMATION

4.1. Criteria for evaluating students' knowledge during the knowledge survey (written survey)

Mark "**excellent**" - the student clearly expresses his point of view on the issues under consideration, giving appropriate examples.
Mark "**good**" - the student admits some errors in the answer
The mark "**satisfactory**" - the student discovers gaps in knowledge of the basic educational and normative material.
The mark "**unsatisfactory**" - the student discovers significant gaps in knowledge of the basic provisions of the discipline, the inability to obtain the correct solution to a specific practical problem with the help of a teacher.

4.2. Criteria for evaluating students' knowledge during testing:

The test result is evaluated on a percentage rating scale. Each student is offered a set of test tasks of 25 questions:
The mark "**excellent**" is 25-22 correct answers.
The mark "**good**" is 21-18 correct answers.
The mark "**satisfactory**" is 17-13 correct answers.
The mark "**unsatisfactory**" is less than 13 correct answers

4.3. Criteria for evaluating students' knowledge in the preparation of reports

The mark "**excellent**" - the problem is identified and its relevance is justified; an analysis of various points of view on the problem under consideration is made and one's own position is logically stated; conclusions are formulated, the topic is fully disclosed, the volume is maintained; the requirements for external design are met, the basic requirements for the report are fulfilled.

The mark "**good**" - mistakes have been made. In particular, there are inaccuracies in the presentation of the material; there is no logical consistency in judgments; the volume of the report is not maintained; there are omissions in the design, there are significant deviations from the requirements for the presentation of materials.

The mark "**satisfactory**" - the topic is only partially covered; factual errors were made in the content of the report; there are no conclusions, the topic of the report is not disclosed.

The mark "**unsatisfactory**" - there is a significant misunderstanding of the problem or the report is not submitted.

4.4. Criteria for evaluating students' knowledge when checking control papers

The mark "**excellent**" - the problem is identified and its relevance is justified; an analysis of various points of view on the problem under consideration is made and

one's own position is logically stated; conclusions are formulated, the topic is fully disclosed, the volume is maintained; the requirements for external design are met, the basic requirements for the abstract are fulfilled

The mark is "**good**" - mistakes have been made. In particular, there are inaccuracies in the presentation of the material; there is no logical consistency in judgments; the volume of the abstract is not maintained; there are omissions in the design, there are significant deviations from the requirements for abstracting.

The mark "**satisfactory**" - the topic is only partially covered; factual errors were made in the content of the abstract; there are no conclusions, the topic of the abstract is not disclosed

The mark "**unsatisfactory**" - there is a significant misunderstanding of the problem or the abstract is not presented at all.

4.5. Criteria of knowledge during the test

The mark "**accepted** " must correspond to the parameters of any of the positive ratings ("excellent", "good", "satisfactory").

The mark "**not accepted** " rating should correspond to the parameters of the "unsatisfactory" rating.

The mark "excellent" – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in situations of increased complexity. At the same time, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be allowed.

The mark "good" – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in standard situations. At the same time, minor errors, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be made.

Mark "satisfactory" – one or more types of educational work provided for in the curriculum have not been completed. The student demonstrates incomplete compliance of knowledge, skills, and abilities with the indicators given in the tables, significant errors are made, a partial lack of knowledge, skills, and skills is manifested in a number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations. –

The mark «unsatisfactory" – the types of educational work provided for in the curriculum have not been completed. demonstrates incomplete compliance of knowledge, skills, and abilities given in the tables of indicators, significant errors are made, a lack of knowledge, skills, and skills is manifested for a large number of indicators, the student experiences significant difficulties in operating knowledge and skills when transferring them to new situations

4.6. Criteria of knowledge during the examination

The mark "excellent" – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in various situations of increased complexity. At the same time, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be allowed. –

The mark "good" – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in standard situations. At the same time, minor errors, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations can be made.

Mark "satisfactory" – one or more types of educational work provided for in the curriculum have not been completed. The student demonstrates incomplete compliance of knowledge, skills, and abilities with the indicators given in the tables, significant errors are made, a partial lack of knowledge, skills, and skills are manifested in a number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations.

The mark "unsatisfactory" – the types of educational work provided for in the curriculum have not been completed. demonstrate incomplete compliance of knowledge, skills, and abilities given in the tables of indicators, significant errors are made, a lack of knowledge, skills, and skills are manifested for a large number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations.

5. ACCESSIBILITY AND QUALITY OF EDUCATION FOR DISABLED PEOPLE

If necessary, persons with disabilities and persons with disabilities are given additional, time to prepare an answer for the test.
When conducting the procedure for evaluating the learning outcomes of disabled people and persons with disabilities, their own technical means can be used.

The procedure for evaluating the learning outcomes of disabled people and persons 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 people with visual impairments:	– in printed form in enlarged font; – in the form of an electronic document.
For people with hearing impairments:	– in printed form; – in the form of an electronic document.
For people with disorders of the musculoskeletal system:	– in printed form, the device; – in the form of an electronic document.

When conducting the procedure for evaluating the learning outcomes of disabled people and persons with disabilities in the discipline, it ensures that the following additional requirements are met, depending on the individual characteristics of the students:

a) instructions on the procedure for conducting the assessment procedure are provided in an accessible form (orally, in writing);

b) an accessible form of assignment of assessment tools (in printed form, in printed form in enlarged font, in the form of an electronic document, assignments are read out by the teacher);

c) an accessible form of providing answers to tasks (written on paper, a set of answers on a computer, orally).

If necessary, for students with disabilities and the disabled, the procedure for evaluating the results of training in the discipline can be carried out in several stages.

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