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
_____ Sukhinin A.A.
April 10, 2026

Department of Biochemistry and Physiology

EDUCATIONAL WORK PROGRAM

for the discipline

BIOLOGICAL CHEMISTRY

The level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary Medicine
Profile: «General clinical veterinary medicine»
Full-time education
Education starts in 2026

Reviewed and adopted
at the meeting of the department
on April 6, 2026.
Protocol No. 17

Head of the dep. of biochemistry and physiology
Doctor of Biological Sciences, professor
_____ L.Y.Karpenko

Saint Petersburg
2026

1. AIMS AND OBJECTIVES OF THE DISCIPLINE

The main goal of the discipline in the training of veterinary doctors is that students acquire knowledge about the laws of the chemical composition, structure and properties of components of the animal body; on the chemical composition, structure and properties of components of the animal organism, metabolism and energy, relationships of metabolism of various substances.

In order to achieve this objective, it is necessary to:

a) The general educational task is to familiarize students with the laws of the chemical composition and metabolism of the animal body and gives a fundamental biological education in accordance with the requirements, applied to higher educational institutions of biological profile.

b) The Applied Task addresses issues related to dynamic biochemistry and provides a conceptual framework for the implementation of interdisciplinary structural and logical linkages for the development of medical thinking skills.

c) A special task is to acquaint students with the modern directions and methodological approaches used in biochemistry to solve the problems of animal husbandry and veterinary medicine, as well as with the achievements in this field.

2. THE LIST OF THE PLANNED RESULTS OF THE DISCIPLINE (MODULE), CORRELATED WITH THE PLANNED RESULTS OF THE REALISED EDUCATIONAL PROGRAM

As a result of the development of the discipline, the student is preparing for the following activities, in accordance with the educational standard GEF B 36.05.01 «Veterinary».

Professional area:

13 Agriculture

Types of tasks of professional activity:

- Medical;
- Expert control;
- Scientific and educational.

Competences of the student, formed as a result of the development of the discipline

The process of studying the discipline is aimed at forming the following **competences:**

a) General professional competence:

GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body.

GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process

GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.

GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital 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-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

Discipline B1.O.16 «Biological chemistry» according to the curriculum is a part formed by participants of educational process of the first block, it is mastered in full-time education in the 3rd and 4th semesters.

When teaching the discipline «Biological chemistry» the knowledge and skills acquired by students in the development of disciplines are used: biological physics, inorganic and analytical chemistry, biology with the basics of ecology, organic, physical and colloid chemistry, Animal anatomy, cytology, histology and embryology, physiology and ethology of animals.

The discipline «Biological chemistry» is the basic, on which most of the following disciplines are built, such as:

1. Clinical endocrinology;
2. Veterinary pharmacology;
3. Pathological physiology;
4. Feeding animals with the basics of reproduction;
5. Laboratory diagnostics;
6. Clinical diagnosis;
7. Internal non-communicable diseases;
8. Immunology;
9. Diseases of laboratory, small and exotic animals;
10. Bird diseases.

4. THE SCOPE OF DISCIPLINE AND TYPES OF ACADEMIC WORK

4.1. THE SCOPE OF THE DISCIPLINE FOR FULL-TIME EDUCATION

Type of educational work	**Hours**	Semesters	
		3	**4**
Classroom classes (total)	**100**	**68**	**32**
Including:			
Lectures, including interactive forms	50	34	16
Practical lessons (PL), including interactive forms, among which are:	50	34	16
practical training (PT)	12	4	8
Self-study	**89**	**40**	**49**
Control	**27**	**-**	**27**
Type of intermediate and final certification (test, exam)	**Test, exam**	**Test**	**Exam**
Total labor intensity hours/credits	**216/ 6**	**108/3**	**108/3**

5. THE CONTENT OF THE DISCIPLINE AND TYPES OF CLASSES

5.1. The content of the discipline (full-time education)

№	The title	Achieved competences	Semester	Types of academic work, including students' self-study and labor intensity (in hours)			
				Lectures	Practical lessons	Practical training	Self-study
1.	**Section 1.** Introduction to Biochemistry . Enzymology	**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.	3	10	8	1	10
2	**Section 2.** Energy Exchange. Biological oxidation	**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.	3	6	6	1	8

3.	**Section 3.** Carbohydrate exchange	**GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:** GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status. **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. 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	10	8	1	8

4.	**Section 4.** Fat exchange	**GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:** GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status. **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. 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	8	8	1	6
		TOTAL OF 3 SEMESTERS		**34**	**30**	**4**	**40**

5	**Section 5.** Protein exchange	**GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:** GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status. **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. 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.	4	2		2	16
6.	**Section 6.** Blood chemistry	**GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:** GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process. GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.	4	4	2	2	16

7.	**Section 7.** Vitaminology	**GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:** GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process. GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.	4	4	2	2	16
8.	**Section 8.** Endocrinology	**GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:** GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process. GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.	4	4	2	2	14

9.	**Section 9.** Biochemical characteristics of individual organs and systems	**GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:** GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process. GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.	4	2	2		14
TOTAL OF 4 SEMESTERS				**16**	**8**	**8**	**76**

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

Correct organization and planned self – work stimulate research and creative activity of students. Self-work should be understood not only as the ability to make independent conclusions and to apply the knowledge, gained in practice, but also as the ability to organize their activities without outside help.

Self-work over the discipline "Veterinary and sanitary expertise" allow to develop skills on the principles of veterinary and sanitary control of the rational use of animal and plant products (controlled by gosvetnadzor), as well as raw materials (for industrial processing of farm and natural fishing resources); environmental protection technologies and equipments; fundamentals of technologies, technical regulation and standardization, professional responsibility; international cooperation in the field of veterinary and sanitary expertise, food safety and protection of the territory of the Russian Federation from the introduction of infectious zooanthroponous and animal diseases; environmental protection; human consciousness and society for the development of the agro-industrial complex of the Russian Federation.

Students self-work illustrates the development of the following qualification requirements:

- the ability to identify problems and interests in the field of quality control and food safety;
- the ability to set an adequate goal, determine the sequence of tasks;
- the ability to find optimal solutions, effective means and methods to achieve the goal;
- the ability to find the necessary information using modern technologies, classify and systematize it;
- the ability to conduct scientific research in the field of food expertise;
- the ability to present the results of their activities, both in written and oral form for the procedure of public presentation, as well as lectures;
- the ability to master the skills of effective business cooperation.

Students self-work over the discipline "Veterinary and sanitary expertise" is the main way of mastering educational material. It is carried out in order to:

- develop and assimilate the educational material of the discipline;
- consolidate and ameliorate knowledge, skills and abilities;
- prepare for upcoming classes and control tasks;
- form the culture of intellectual work, independency and initiative in research and education.

Students self-work includes the development of theoretical material and preparation for practical classes in the basics of technical regulation and standardization of livestock products, TR and GSS of the Russian Federation, the HACCP system, food safety requirements: meat and meat products, milk and dairy products, fish and fish products, raw materials and technological processes of children's and specialized nutrition and others. food security issues.

The forms of student's self-work over the discipline "Veterinary and sanitary expertise" are:

- acquaintance with the work program;
- making notes and processing lecture material;
- preparation for group classes, including:

a) selection of necessary sources of information (literature, online publications, regulatory framework);

b) taking notes of educational, methodological and scientific literature;

c) processing and analysis of laws and regulations;

d) self-control of the processed questions and topics of the curriculum;

In addition, students self-work in a free form is realized through the preparation of reports and articles for student scientific conferences on the problems of veterinary and sanitary expertise,

food security, rational development of the agro-industrial complex of the Russian Federation and the use of natural resources, innovative technologies and technical regulation in the field of veterinary and sanitary expertise, processing of meat, poultry, dairy, etc. raw materials, eggs, honey and bee products, vegetable raw materials, raw materials for food ghee of animal origine, the use of biotechnology.

During the practical classes, the discussion of the topic is conducted in a free creative form. Students discuss with the teacher not only the questions formulated in the educational and methodological complex, but also ask questions that they have during preparation for the seminar, and state their own position on a particular problematic issue in a reasoned manner.

Preparing for the lesson involves the study of theoretical lecture material and regulatory documents. When solving problems, it is recommended to analyze the conditions, formulate a solution clearly and competently, giving references to the relevant legal norms. In order to assimilate the material and better prepare for future professional activity, it is necessary to strive to change the conditions of the task in order to choose the best solution to a specific life situation.

The type of tasks for students' self-work is determined by the teacher through the work program and assessment funds.

Educational and methodological materials for self-work of disabled students are provided in forms adapted to the limitations of their health and perception of information and can be specified depending on the contingent of students.

6.1. Guidelines for self -work

1. Konopatov, Y. V. Animal Biochemistry : Manual / Y. V. Konopatov, S. V. Vasilyeva. - St. Petersburg : Lan, 2025. — 384 pp. — ISBN 978-5-507-51016-0. — Tekst : elektronnyj // Lan' : elektronno-bibliotechnaya sistema. — URL: https://e.lanbook.com/book/499430 (accessed: 03.02.2026).
2. Vasilyeva, S.V. Clinical biochemistry of cattle [Electronic resource] : Training manual / S.V. Vasilyev, Yu.V. Konopatov. - Electron. dan. - St. Petersburg : Lan, 2017. - 188 pp. - Access mode: https:///e.lanbook.com/book/92624 - Zak. from the screen(accessed: 25.06.25)
3. Laboratory Manual for Practical Biochemistry : uchebnoe posobie / O. L. Nosareva, E. A. Stepovaya, T. S. Fedorova [i dr.]. — Tomsk : SibGMU, 2019. — 174 s. — Tekst : elektronnyj // Lan' : elektronno-bibliotechnaya sistema. — URL: https://e.lanbook.com/book/138684 (accessed: 25.02.26).
4. Collection of test tasks in biological chemistry for students of foreign faculty (Training manual) : uchebnoe posobie. — Orenburg : OrGMU, 2018. — 134 s. — Tekst : elektronnyj // Lan' : elektronno-bibliotechnaya sistema. — URL: https://e.lanbook.com/book/161660 (accessed: 03.02.2026).

6.2. Literature for self-work

1. Rogozhin, V.V. Workshop on Biochemistry [Electronic resource]: Training manual / V.V. Rogozhin. - Electron. dan. - St. Petersburg : Lan, 2013. - 544 p. -.Get-to-Stupa mode: https://e. /book/38842 - Zag. from the screen(accessed: 03.02.2026)

7. THE LIST OF BASIC AND ADDITIONAL LITERATURE NECESSARY FOR THE EDUCATION OF THE DISCIPLINE

a) Basic literature:

1. Konopatov, Y. V. Animal Biochemistry : Manual / Y. V. Konopatov, S. V. Vasilyeva. - St. Petersburg : Lan, 2025. — 384 pp. — ISBN 978-5-507-51016-0. — Tekst : elektronnyj // (accessed: 03.02.2026).

2. Vasilyeva, S.V. Clinical biochemistry of cattle [Electronic resource] : Training manual / S.V. Vasilyev, Yu.V. Konopatov. - Electron. dan. - St. Petersburg: Lan, 2017. - 188 pp. - Access mode: https:///e.com/book/92624 - Zak. from the screen(accessed: 25.06.25)
3. Basics of Biological Chemistry [Electronic Resource]: Textbook / E.V. Gorchakov [et al.]. - Electron. dan. - St. Petersburg : Lan, 2019. - 208 p. - Access mode: https:///e.com/book/112688 - View. screen(accessed: 03.02.2026)

б) Additional literature:

1. Klopov, M.I. Biologically active substances in the physiological and biochemical processes in the animal's body [Electronic resource]: training manual / M.I. Klopov, V.I. Maksimov. - Electron. dan. - St. Petersburg : Lan, 2012. - 448 p. - Access mode: https://.com/book/4228 - View(accessed: 03.02.2026)
2. Krishtoforova, B.V. Structural and functional features of endocrine leprosy in animals [Electronic resource]: educational manual / B.V. Krishtoforov, N.V. Saenko. - Electron. dan. - St. Petersburg : Lan, 2016. - 88 pp. - Access mode: https://e. com/book/87582 - View. from the screen(accessed: 03.02.2026)
3. Petushok, N. E. Osnovy biohimii = Basics of biochemistry : uchebnoe posobie / N. E. Petushok ; pod redakciej V. V. Lelevicha. — Grodno : GrGMU, 2021. — 400 s. — ISBN 978-985-595-326-6.
4. Laboratory Manual for Practical Biochemistry : uchebnoe posobie / O. L. Nosareva, E. A. Stepovaya, T. S. Fedorova [i dr.]. — Tomsk : SibGMU, 2019. — 174 s
5. Collection of test tasks in biological chemistry for students of foreign faculty (Training manual) : uchebnoe posobie. — Orenburg : OrGMU, 2018. — 134 s. — Tekst : elektronnyj
6. Deryugina, A. V. Electrophysiology. Physiology of excitable tissues : uchebno-metodicheskoe posobie / A. V. Deryugina, M. A. Shabalin, M. V. Zolotova. — Nizhnij Novgorod : NNGU im. N. I. Lobachevskogo, 2020. — 71 s.
7. Shabalin, M. A. Physiology of the respiratory and digestive systems : uchebno-metodicheskoe posobie / M. A. Shabalin, A. V. Deryugina, M. V. Zolotova. — Nizhnij Novgorod : NNGU im. N. I. Lobachevskogo, 2021. — 44 s.
8. Normal physiology : uchebnoe posobie. — Majkop : MGTU, 2020. — 114 s. — ISBN 978-5-907004-53-5.

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

1. https://meduniver.com –Medical information site
2. https://www.twirpx.com – Anything for a student
3. http://www.drau.ru –Biochemistry for Students

Electronic library systems:

1. ELS «SPBGUVM»
2. ELS «Publishing «Lan»
3. ELS «Student Consultant»
4. The legal reference system of «ConsultPlace»
5. University Information System «RUSSIA»
6. POLPRED.COMFull-text database POLPRED.COM
7. Scientific electronic library ELIBRARY.RU
8. Russian Scientific Network
9. Electronic library system IQlib
10. Database of international scientific citation indices WebofScience

11. Full-text interdisciplinary database on agricultural and environmental sciences ProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE

12. Electronic books of the publishing house «Prospectus of Science» http://prospektnauki.ru/ebooks/

13. Collection «Agriculture. Veterinary» of «Quadro» publishing house 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 them organize the process of studying this discipline optimally.

The content of methodological recommendations, as a rule, may include:

• Tips 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 effective for academic work (from 8-14 hours), followed by afternoon time (from 16-19 hours) and evening time (from 20-24 hours). 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 master 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).

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 read again 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 transist most of the complexity 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 leave 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 takimg notes of written sources, the last 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.

When working 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, classification cod, topic, list of issues under consideration, volume in hours and links to recommended literature are provided. For classes conducted in interactive forms, its 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. For student, it is necessary, to study or repeat theoretical material on a given topic when preparing for a practical lesson for students.

When preparing for a practical lesson, the student is recommended to follow the following algorithm;

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

2) 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 are tasks. The basis of the task 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 a prerequisite for correct thinking and speech.

• Practical (seminar) classes perform the following tasks:

- stimulate regular study of recommended literature, as well as 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 verify the correctness of previously acquired knowledge;
- initiate skills of independent self-thinking, oral presentation;
- contribute to the free use of terminology;
-provide the teacher with the opportunity to systematically monitor the level of independent work of students.

Methodological guidelines for practical (seminar) classes on 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 the student's self-work on mastering the 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 personal hypotheses and ideas. In addition, the skills of research work necessary for further professional activityare developed.

When starting to study 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 summary from the studied sources. All summaries 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). On each card, it is advisable to record the thought of the author of the book or a fact from this book on only one specific issue. 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 for the course, recommendations for completing homework.

Testing is a conrol 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. A 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

As part of the implementation of the discipline, educational 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 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 Information technologies

For the educational process of the discipline is previewed the use of information technologies:

- **practical classes using multimedia;**
- **interactive technologies (dialogues, collective discussion on various topics for realization a particular educational and professional task);**
- **interaction with students via e - mail;**
- **community work in the electronic information and educational environment of St. Petersburg State University: https://spbguvm.ru/academy/eios/**

11.2. Software

The list of licensed and free- distributed software, including national programs

p/p	Title of technical and computer-based training modules recommended by section and module	License
1	MS PowerPoint	67580828
2	LibreOffice	free SW
3	OS Alt Education 8	AAO.0022.00
4	ABIS "MARK-SQL"	02102014155
5	MS Windows 10	67580828
6	KonsultantPluse System	503/KL
7	Android OC	free SW

12.THE MATERIAL AND TECHNICAL BASIS NECESSARY FOR THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS ON DYSCI-PLIN

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
Biological chemistry	**103** (99 Moskovsky Prospekt, St. Petersburg, 196084) 43,1 м^2/ 30seats. A classroom for conducting seminar-type classes,	*Specialized furniture:* desks, chairs, tabouret, educational board. *Technical training tools:*

	group and individual consultations, ongoing monitoring and intermediate certification	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 Inter-

		net 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:

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Annex 1

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
Of Higher Education
«Saint-Petersburg State University of Veterinary Medicine»

Department of Biochemistry and Physiology

FUND OF ASSESMENT TOOLS
for the discipline

«Biological Chemistry»

Level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary Medicine
Profile: «General clinical veterinary medicine»
Full-time education.

Education starts in 2026

Saint Petersburg
2026

1. PASSPORT OF THE FUND OF ASSESMENT TOOLS

Table 1

№	Assessed modules of a discipline	Acquired competence	Assesment tool
1.	Introduction to biochemistry. Fermentology	GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process;	Seminar, tests
2.	Energy exchange		Seminar, tests
3.	Carbohydrate metabolism	**GPC-1.** Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:	Seminar, tests
4.	Fat metabolism		Seminar, tests

5.	Protein metabolism	GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.. **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. 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.	Seminar, tests
6.	Blood Biochemistry	**GPC-1.** Is able to determine the biological status, normal clinical signs of organs and systems of the animal body. GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process. GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.	Seminar, tests
7.	Vitaminology		Seminar, tests
8.	Endocrinology		Tests
9.	Biochemical features of individual organs and systems		Tests, essay

List of assessment tools

Table 2

№	Name of the evaluation tool	A brief description of the assessment tool	Presentation of an evaluation tool in the fund
1.	Seminar	A means of controlling the assimilation of educational material of a topic, section or sections 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.	Essay	The product 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 of the essays

2. INDICATORS AND CRITERIA FOR ASSESSING COMPETENCIES AT VARIOUS STAGES OF THEIR FORMATION, DESCRIPTION OF ASSESSMENT SCALES

Table 3

Planned results of competency acquaired	The level of development				Assesment tool
	unsatisfactory	**satisfactory**	**good**	**excellent**	
GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body:					
GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process.	The level of knowledge is below the minimum requirements, gross errors have occurred	The minimum acceptable level of knowledge, many uncritical errors were made	The level of knowledge in the volume corresponding to the training program, uncritical errors were made	The level of knowledge in the volume corresponding to the training program, without errors	Seminar, tests, essay
GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.	Basic skills were not demonstrated when solving standard tasks, and gross errors occurred	Basic skills have been demonstrated, typical tasks with minor errors have been solved, all tasks have been completed, but not in full	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 flaws	All basic skills have been demonstrated, all basic tasks have been solved with some minor flaws, and all tasks have been completed in full	Seminar, tests, essay
GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.	Basic skills were not demonstrated when solving standard tasks, and gross	There is a minimal set of skills for solving standard tasks with	Basic skills are demonstrated in solving standard tasks with some	Demonstrated skills in solving non-standard tasks without errors and shortcomings	Seminar, tests, essay

	errors occurred	some shortcomings	shortcomings		
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, gross errors have occurred	The minimum acceptable level of knowledge, many uncritical errors were made	The level of knowledge in the volume corresponding to the training program, uncritical errors were made	The level of knowledge in the volume corresponding to the training program, without errors.	Seminar, tests, essay
GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained;	Basic skills were not demonstrated when solving standard tasks , and gross errors occurred	Basic skills have been demonstrated, typical tasks with minor errors have been solved, all tasks have been completed, but not in full	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 flaws	All basic skills have been demonstrated, all basic tasks have been solved with some minor flaws, and all tasks have been completed in full	Seminar, tests, essay
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.	Basic skills were not demonstrated when solving standard tasks , and gross errors occurred	There is a minimal set of skills for solving standard tasks with some shortcomings	Basic skills are demonstrated in solving standard tasks with some shortcomings	Demonstrated skills in solving non -standard tasks without errors and shortcomings	Seminar, tests, essay

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

3.1. Typical tasks for the current control of academic progress

3.1.1. Questions for the seminar

Questions for competence assessment::

GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body.

GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process.

1. Vitamin A: structure, biological role.
2. Vitamin D: structure, biological role.
3. Vitamin E: structure, biological role.
4. Vitamin K: structure, biological role.
5. Vitamin B1: structure, coenzyme form, biological role.
6. Vitamin B2: structure, coenzyme form, biological role.
7. Vitamin B12: structure, coenzyme form, biological role.
8. Folic acid: structure, biological role.
9. Nicotinic acid: structure, biological role.
10. Pantothenic acid: structure, biological role.
11. Vitamin C: structure, biological role.

GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status s.

1. General characteristics of carbohydrates: classification, structure of the main representatives, functions in the body.
2. Digestion and absorption of carbohydrates in monogastric animals.
3. Digestion and absorption of carbohydrates in polygastric animals.
4. General characteristics of lipids: classification, structure of the main representatives, functions in the body.
5. Digestion and absorption of lipids in animals.

GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.

1. Blood plasma electrolytes – Na, K, Cl. Their biological role.
2. Blood plasma minerals - Ca, P, Mg. Their biological role.
3. Blood trace elements: Fe, Cu, Zn. Their role in metabolic processes.
4. Blood trace elements: Mn, Co, I, Se. Their role in metabolic processes.
5. Blood composition.
6. Respiratory function of the blood. The role of hemoglobin in the transport of gases.
7. Blood buffer systems, their role in the homeostasis of the animal body.
8. Plasma proteins are the main representatives and functions.

9. Bile: chemical composition, functions.
10. Pathological components of urine.

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;

Biochemistry: the purpose and objectives of the discipline.
1. The chain of biological oxidation. The role in energy metabolism.
2. Shortened chains of biological oxidation.
3. The structure and role of ATP. The main mechanisms of synthesis (substrate and oxidative phosphorylation).
4. Anaerobic glycolysis: reactions, biological role.
5. The Krebs cycle: reactions, role.
6. Gluconeogenesis: biological significance, reactions.
7. Glycogen metabolism: synthesis and decomposition; biological role.
8. The pentose phosphate pathway of glucose oxidation: reactions, biological role.
9. The concept of enzymes, their structure. Characteristics of the properties of enzymes.
10. Nomenclature and classification of enzymes. The enzyme cipher.
11. Factors affecting the rate of enzymatic reactions (temperature, pH, enzyme concentration, substrate concentration).
12. The importance of determining the activity of enzymes
13. The specificity of enzymes.

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

The structure of bile acids. The role of bile in the digestive process.
1. Synthesis of triglycerides in the intestinal wall.
2. Oxidation of fatty acids with an even number of carbon atoms.
3. Glycerol oxidation.
4. Synthesis of fatty acids.
5. General characteristics, biological significance and reactions of synthesis of ketone bodies.
6. Cholesterol: structure, synthesis, biological significance in the body of animals.
7. Phospholipids: structure, biological significance.
8. Digestion and absorption of proteins in monogastric animals.
9. Digestion and absorption of proteins in ruminants.

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. Putrefaction of amino acids in the intestine. Methods of neutralization of putrefaction products.
2. Transformation of amino acids in tissues: deamination of amino acids
3. Transformation of amino acids in tissues: transamination of amino acids

4. Amino acid conversion in tissues: decarboxylation of amino acids
5. Ketogenic and glucogenic amino acids
6. Urea cycle: reactions, biological significance.
7. Chromoproteins – examples, biological significance, heme structure.
8. Heme synthesis
9. Hemoglobin breakdown. Bilirubin metabolism.
10. Nucleoproteins – biological role. The structure of nucleotides.
11. Synthesis of purine nucleotides.
12. Synthesis of pyrimidine nucleotides.
13. The breakdown of purine nucleotides.
14. The breakdown of pyrimidine nucleotides.
15. Protein biosynthesis

4.1.2. Tests

Competency assessment tests:

GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body.

GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process.

1. The skin is the main site of synthesis of what?
    a) *Vitamin D3*
    b) *Vitamin A*
    c) *Cholesterol*
    d) *Coenzyme A*
2. What is the main mineral substance of the shell?
    a) *Calcium carbonate*
    b) *Phosphorus carbonate*
    c) *Bicarbonate*
    d) *Hydrochloric acid*
3. *What is blood?*
    a) *Connective tissue*
    b) *Liquid support tissue*
    c) *Muscle tissue*
    d) *Epithelial tissue*
4. What is bilirubin?
    a) *Bile pigment*
    b) *Amino acid breakdown product*
    c) *Cholesterol breakdown product*
    d) *Enzyme*
5. Under what circumstances does the bilirubin level increase?
    a) *Impaired liver function*
    b) *Fasting for 5-6 hours*

c) *Enhanced protein nutrition*
d) *All of the above options are suitable*

6. When does the level of urea increase?
   a) *Kidney disease*
   b) *Blockage of the bile ducts*
   c) *Demodecosis*
   d) *Allergic reactions of the immediate type*
7. Can there be features of blood parameters in different breeds within the same species?
   a) *Yes*
   b) *No*
   c) *Only in pigs and cattle*
   d) *Only in horses*
8. What are blood minerals?
   a) *Potassium and calcium*
   b) *Calcitonin and kalitonin*
   c) *AlAt and AsAt*
   d) *Albumin and globulin*
9. What is milk from the point of view of the grain of physcolloid chemistry?
   a) *Dispersed / polydisperse system*
   b) *Gel / sol*
   c) *Ideal system*
   d) *Aerosol*
10. What is colostrum?
   a) *Breast secret secreted several days after childbirth*
   b) *Fermented milk*
   c) *Milk in Ukrainian*
   d) *Casein secret of the nipples of large and small cattle, formed by improper organization of machine milking*
11. What are the components that form an egg?
   a) *Protein, yolk, subcortical shells, shell*
   b) *Protein, yolk, shell*
   c) *Protein, yolk, chicken, shell*
   d) *Protein, yolk, subcortical shells, shell, chicken*
12. What is anuria?
   a) *cessation of urine excretion*
   b) *reducing the daily amount of urine*
   c) *increasing the amount of urine*
   d) *absence of uridine in urine*
13. What determines the color of urine?
   a) *From pigments*
   b) *From dyes*
   c) *From urea*
   d) *All the answers are wrong*

14. Is the smell of acetone in urine the norm?
    a) *No, this is a sign of ketosis*
    b) *Yes, it is the norm*
    c) *It is the norm in some dog breeds*
    d) *It is a consequence of the predominance of vegetable food in the diet*
15. What is proteinuria?
    a) *positive reaction to protein in urine*
    b) *negative reaction to protein in urine*
    c) *positive reaction to carbohydrates in urine*
    d) *simultaneous increase in total protein in both blood and urine*

GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.

1. What are albumins?
    a) *Proteins*
    b) *Minerals*
    c) *Nitrogen-free substances*
    d) *Enzymes*
2. Which of the following belongs to the class of proteins?
    a) *Globulins*
    b) *AlAt, AsAt*
    c) *Calcium and phosphorus*
    d) *Creatinine*
3. What is urea?
    a) *A product of protein metabolism*
    b) *A product of glucose breakdown*
    c) *A consequence of active fermentation of cellulose in the rumen of polygastric animals*
    d) *An integral part of the tubules of the kidneys*
4. Which protein is the main one in milk?
    a) *Casein*
    b) *Collagen*
    c) *Albumin*
    d) *Glycine*
5. 5. What is the main carbohydrate in milk?
    a) *Lactose*
    b) *Glucose*
    c) *Cellulose*
    d) *Glycogen*
6. Which lipids are the main ones in milk?
    a) *Triglycerides*
    b) *Cholesterol*
    c) *Steroids*
    d) *Purine bases*

7. What is casein?
    a) *Phosphoprotein*
    b) *Lipoprotein*
    c) *Glycoprotein*
    d) *Simple protein*
8. What is milk sugar?
    a) *Lactose*
    b) *Sucrose*
    c) *Glucose*
    d) *Maltose*
9. What monosaccharides does lactose consist of?
    a) *Glucose and galactose*
    b) *2 glucose molecules*
    c) *Glucose and fructose*
    d) *Glucose and ribose*
10. What is milk fat?
    a) *Neutral fat*
    b) *Phospholipids*
    c) *Steroid*
    d) *Lipoprotein*
11. What is glycosuria?
    a) *positive reaction to glucose in urine*
    b) *negative reaction to glucose in urine*
    c) *positive reaction to arabinose in urine*
    d) *simultaneous increase in glucose in both blood and urine*
12. Which of the following is the main carbohydrate of muscles?
    a) *Glycogen*
    b) *Glucose*
    c) *Starch*
    d) *Glycogen and starch*
13. What is actin?
    a) *Muscle tissue protein*
    b) *Liver protein*
    c) *Muscle tissue lipids*
    d) *Liver lipid*
14. What is myosin?
    a) *Muscle tissue protein*
    b) *Liver protein*
    c) *Muscle tissue lipid*
    d) *Liver lipid*
15. Who is the main carbohydrate of the liver?
    a) *Glycogen*
    b) *Fiber*
    c) *Lactose*

d) Sucrose

GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.

1. What is ketonuria?
   a) the appearance of acetone, β-hydroxyasluoric acid, acetoacetic acid in urine
   b) the appearance of acetone, valerian and acetic acids in urine
   c) the appearance of ketorol in urine
   d) the absence of ketone bodies in urine
2. What determines the nutritional value of meat?
   a) All possible answers are correct
   b) The usefulness of proteins
   c) The amino acid composition of meat proteins
   d) The presence of essential amino acids in the composition of meat proteins
3. What is meat rotting?
   a) Decomposition of meat under the influence of microflora enzymes
   b) Cleavage of protein molecules under the influence of their own enzymes
   c) An increase in the content of ATP and its own enzymes in meat
   d) There is no correct answer among the listed
4. Are there organic components in the bone?
   a) Yes
   b) No
   c) Only in elderly organisms
   d) Only in growing organisms
5. What is synthesized in the liver?
   a) All the above answers are correct
   b) Urea
   c) Albumin
   d) Glycogen
6. What is ferritin?
   a) the form of iron storage in the liver
   b) the form of zinc storage in the liver
   c) the form of hemoglobin storage in the liver
   d) bile acid
7. What is creatine phosphate?
   a) the main macroerg of muscle tissue
   b) the main building material of muscle tissue
   c) the main protective protein of muscle tissue
   d) the main carbohydrate of muscle tissue
8. 8. Which of the above is typical for muscle tissue?
   a) high metabolic rate
   b) low metabolic rate

c) *average metabolic rate*
d) *lack of metabolism*

9. What is the form of vitamin B12 deficiency?
   a) *Anemia and neurological disorders*
   b) *Vomiting and diarrhea*
   c) *c. Lethargy and apathy*
   d) *Hypovitaminosis B12 is not found in nature, it is created only experimentally and leads to instant death*
10. Which of the following applies to pancreatic hormones?
   a) *Insulin and glucagon*
   b) *Adrenaline and norepinephrine*
   c) *c. Thyroxine and calcitonin*
   d) *Somatostatin and thyrooliberin*
11. Which of the above applies to androgens?
   a) *Testosterone*
   b) *Estrogen*
   c) *Parathyroid hormone*
   d) *Cortisol*
12. What is the main function of progesterone?
   a) *Maintenance of pregnancy*
   b) *Growth and development of the body*
   c) *Response to stress factors*
   d) *d. Regulation of blood glucose levels*
13. What is the function of blood buffer systems?
   a) *Maintaining blood pH at a constant level*
   b) *Creating volume in the blood vessels*
   c) *Moving blood through the vessels*
   d) *They are a reserve buffer of the body's minerals*
14. What is the main function of vitamin K?
   a) *Regulation of blood clotting processes*
   b) *Regulation of mineral metabolism*
   c) *c. Reproduction and sexual function*
   d) *Participates in the active growth of fur and claws*
15. Which of the listed substances contains phosphorus?
   a) *DNA*
   b) *Glucose*
   c) *Bilirubin*
   d) *Urea*

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. 1. Which reactions require cytochromes?
   a) biological oxidation
   b) transamination
   c) decarboxylation
   d) hydrolysis

2. During biological oxidation, energy is released sufficient to form what?
   a) 3 ATP
   b) 2 ATP
   c) c. 26 ATP
   d) During biological oxidation, only thermal energy is released

3. What is the main purpose of the pentose phosphate glucose cleavage pathway?
   a) formation of NADP*H, synthesis of pentose phosphates
   b) oxidation of glucose
   c) supply of the substrate of the gluconeogenesis process
   d) formation of lactate

4. What compounds are glucose formed from during gluconeogenesis?
   a) non-carbohydrate compounds
   b) pentoses
   c) aldohexoses
   d) ketohexoses

5. Specify the electron donor in the respiratory chain?
   a. iron
   б. copper
   в. hydrogen
   г. sulfur

6. Where is biological oxidation carried out?
   a) in the mitochondria
   b) in lysosomes
   c) in blood plasma
   d) in red blood cells

7. What are enzymes by chemical nature?
   a) proteins
   b) lipids
   c) carbohydrates
   d) vitamins

8. What is an apoenzyme?
   a) the protein part of a complex enzyme

b) a simple enzyme
c) the non-protein part of a complex enzyme
d) a complex enzyme

9. Which class of enzymes catalyzes redox reactions?
   a) oxidoreductases
   b) hydrolases
   c) transferases
   d) lyases

10. What classes of enzymes are involved in CBT?
   a) oxidoreductases
   b) transferases
   c) hydrolases
   d) synthetases

11. What is substrate phosphorylation?
   a) formation of ATP without oxygen
   b) formation of ATP with oxygen
   c) synthesis of phosphoric acid
   d) synthesis of phospholipids

12. What explains the Koshland theory?
   a) relative specificity of enzymes
   b) absolute specificity of enzymes
   c) direct specificity of enzymes
   d) reverse specificity of enzymes

13. What explains Fischer's theory?
   a) absolute specificity of enzymes
   b) relative specificity of enzymes
   c) direct specificity of enzymes
   d) reverse specificity of enzymes

14. Which class of enzymes catalyzes the transfer of groups, but the acceptor is always a water molecule?
   a) hydrolases
   b) oxidoreductases
   c) ligases
   d) lyases

15. How many digits does the enzyme cipher contain?
   a) 4
   b) 3
   c) 2

d) 1

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

1. 1. What is the main protein of the liver?
    a) *Globulins*
    b) *Albumins*
    c) *Troponins*
    d) *Glycogen*
2. What is collagen?
    a) *Intercellular matrix protein*
    b) *Intercellular matrix carbohydrate*
    c) *Intercellular matrix lipid*
    d) *Active form of vitamin B2*
3. What vitamin is necessary for collagen synthesis?
    a) *Ascorbic acid*
    b) *Vitamin B12*
    c) *Pantothenic acid*
    d) *Vitamin E*
4. What refers to contractile proteins of muscle tissue?
    a) *Actin, myosin, tropomyosin, troponin*
    b) *Actin, myosin, relaxin*
    c) *Tropomyosin, troponin, natridiuretic peptide*
    d) *Actin, myosin, tropomyosin, myositis, miasis*
5. Who is the main carbohydrate of muscle tissue?
    a) *Glycogen*
    b) *GAG*
    c) *Monosaccharides*
    d) *All listed carbohydrates*
6. What is glycogen?
    a) *the main carbohydrate of muscle tissue*
    b) *the main macroerg of muscle tissue*
    c) *the main protective protein of muscle tissue*
    d) *the main building material of muscle tissue*
7. What are cerebrazides?
    a) *lipids*
    b) *proteins*
    c) *amino acids*
    d) *biologically active amines*
8. What is the main energy substrate for the central nervous system?
    a) *glucose*
    b) *ketone bodies*
    c) *fatty acids*
    d) *glycogen*

9. What are the effects of insulin and glucagon?
    a) *Blood glucose level*
    b) *Blood urea level*
    c) *Blood pressure*
    d) *Regulate the synthesis of sugar-lowering hormone*
10. What is the most common sulfur in the body?
    a) *Amino acids*
    b) *DNA*
    c) *ATP*
    d) *Free state*
11. What is blood serum?
    a) *plasma devoid of fibrinogen*
    b) *blood plasma devoid of hemoglobin*
    c) *blood plasma devoid of urobilinogen*
    d) *blood plasma with fibrinogen*
12. What is synthesized from tryptophan in the animal body?
    a) *nicotinic acid amide*
    b) *riboflavin*
    c) *pantothenic acid*
    d) *vikasol*
13. What is oncotic pressure?
    a) *The pressure of plasma proteins*
    b) *The difference between systolic and diastolic pressure*
    c) *The pressure of blood electrolytes on the walls of blood vessels*
    d) *Intracranial pressure*
14. Under what conditions is there a decrease in glucose levels?
    a) *starvation*
    b) *stress*
    c) *diabetes mellitus*
    d) *food consumption*
15. What is the main function of albumin?
    a. *transport of biologically active substances (drugs, amino acids, etc.)*
    б. *structural (part of the membranes of the tubules of the kidneys)*
    в. *maintenance of the level of oxygenation*
    г. *allergic reactions*

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. What protein is contained inside red blood cells?
    a) *hemoglobin*
    b) *albumin*
    c) *heme*
    d) *iron*

2. Which of the above applies to the protein components of blood serum?
    a) *Albumin and globulin*
    b) *Urea and creatinine*
    c) *Erythrocytes and neutrophils*
    d) *Amino acids*
3. Which of the above applies to nitrogen-free organic substances of blood serum?
    a) *Glucose*
    b) *Amino acids*
    c) *Globulin*
    d) *Phosphorus*
4. What is the place of albumin protein synthesis?
    a) *Liver*
    b) *Kidneys*
    c) *Spleen*
    d) *Interstitial fluid*
5. What are the functions of albumin?
    a) *Transport of substances and maintenance of osmotic pressure*
    b) *Cellular respiration and activation of enzymes*
    c) *Maintenance of blood pH constancy and storage of important trace elements*
    d) *Albumin does not have any specific functions*
6. Which of the following does trasferrin relate to?
    a) *Beta globulins*
    b) *Albumins*
    c) *Alpha globulins*
    d) *Gamma globulins*
7. Which of the following does hemopexin belong to?
    a) *Beta globulins*
    b) *Albumins*
    c) *Alpha globulins*
    d) *Gamma globulins*
8. What is synthesized in B lymphocytes?
    a) *Gamma globulins*
    b) *Albumins*
    c) *Alpha globulins*
    d) *Beta globulins*
9. Which classes of immunoglobulins appear first in the process of forming an immune response, being primary antibodies?
    a) *Class M*
    b) *Class A*
    c) *Class G*
    d) *Class E*

10. Which classes of immunoglobulins carry out local immunity on mucous surfaces?
    a) Class A
    b) Class M
    c) Class G
    d) Class E
11. The synthesis of ketone bodies begins with the interaction of which two molecules?
    a) Acetyl-CoA
    b) Acetone
    c) Acetylene
    d) AlaT
12. What functional group is present in the structure of cholesterol?
    a) -OH
    b) $-NH_2$
    c) -COOH
    d) -C=O
13. What is formed by the interaction of glycine and cholic acid?
    a) Glycocholic acid
    b) Taurocholic acid
    c) Deoxycholic acid
    d) Cholic acid
14. What is formed by the interaction of cholic acid and taurine?
    a) Taurocholic acid
    b) Deoxycholic acid
    c) Cholic acid
    d) Glycocholic acid
15. What is the name of the ketone body with the formula: $H_3C-C(O)-CH_3$?
    a) Acetone
    b) Glycerin
    c) Urea
    d) Choline

3.2. Standard tasks for intermediate certification

3.2.1. Topics of the essay

Topics of the essay for competence assessment::

GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body.

GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process

GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.

GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital 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-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.

According to the section "Peculiarities of biochemistry of different animal species":

Features of dog biochemistry

1.Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the dog's body.
2. Biochemical features of the growth and development of puppies.
3. Features of biochemical processes of digestion of dogs.
4. Biochemical characteristics of dogs of different ages.

Features of cat biochemistry

4. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the cat's body.
5. Biochemical features of the growth and development of kittens.
6. Features of biochemical processes of cats' digestion.
7. Biochemical characteristics of cats of different ages.

Features of the biochemistry of cattle

8. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the ruminant organism.
9. Features of the biochemical composition of cattle milk.
10. Biochemical features of growth and development of calves.
11. Features of the biochemical composition of sheep and goat milk.
12. Biochemical features of the growth and development of goats and lambs.
13. Features of the biochemical processes of ruminant digestion.
14. Features of biochemical parameters of muscle tissue and ruminant meat.

Features of horse biochemistry

15. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the horse's body.
16. Features of the biochemical composition of mares' milk. Biochemical features of the growth and development of foals.
17. Features of biochemical processes of digestion of horses.
18. Features of biochemical parameters of muscle tissue and meat of horses.
19. Features of biochemical blood parameters characterizing metabolic processes in horses at different degrees of physical activity.

Features of pig biochemistry

20. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of pigs.
21. Features of the biochemical composition of pig milk. Biochemical features of piglet growth and development.
22. Features of biochemical processes of pig digestion.
23. Features of biochemical parameters of muscle and adipose tissues, pig meat.

Features of bird biochemistry

24. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of poultry.
25. Biochemistry of chicken and turkey eggs.
26. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of waterfowl.
27. Biochemistry of duck and goose eggs.
28. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the quail organism. Biochemistry of a quail egg.
29. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the parrot organism. Features of plumage and coloring.
30. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of birds of prey. Features of digestive processes.
31. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body in the tissues of ostriches. Biochemistry of the ostrich egg.
32. Biochemistry of integumentary tissues and their derivatives in birds of different species (beak, feather, claws, membranes, etc.).

Features of reptile biochemistry

33. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of turtles.

34. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of lizards.
35. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of snakes.
36. Biochemistry of reptile eggs. Biochemical features of reptile growth and development.

Features of amphibian biochemistry
37. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of frogs.
38. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of salamanders and worms.
39. Biochemistry of amphibian reproduction. Biochemical features of the growth and development of frogs.
40. Biochemical processes associated with the processes of hibernation and esthivation in amphibians.

Features of fish biochemistry
41. Comparative features of biochemical parameters of metabolic processes in the blood and tissues of marine and freshwater fish (bone).
42. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of cartilaginous fish.
43. Biochemistry of fish reproduction. Biochemical features of fish growth and development on the example of salmon.
44. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of sturgeon fish.
45. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of salmon fish.
46. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of ornamental fish.
47. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of commercial fish.

Features of rodent biochemistry
48. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of rats and mice.
49. Features of the biochemical composition of milk of rats, mice and guinea pigs. Their biochemical features of growth and development.
50. Features of the biochemical processes of rodent digestion.
51. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of guinea pigs (guinea pigs and capybaras).

Features of biochemistry of fur-bearing animals

52. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the body of foxes, arctic foxes, lynxes.
53. Characteristics of biochemical parameters of blood and other tissues characterizing the metabolic processes of the rabbit body.
54. Features of biochemical processes of rabbit digestion.
55. Features of biochemical parameters of muscle tissue and rabbit meat.
56. Features of the biochemical composition of rabbit milk. Biochemical features of the growth and development of baby rabbits.
57. Biochemistry of integumentary tissues and their derivatives in fur-bearing animals of different species.

3.2.2. List of questions for the test

GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body.

GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process.

1. General characteristics of hormones.
2. Humoral regulation of carbohydrate metabolism.
3. Humoral regulation of lipid metabolism.
4. Humoral regulation of protein metabolism.
5. Humoral regulation of metabolism of Ca and R.
6. Humoral regulation of water-salt metabolism in the body.
7. Vitamin A: structure, biological role.
8. Vitamin D: structure, biological role.
9. Vitamin E: structure, biological role.
10. Vitamin K: structure, biological role.
11. Vitamin B1: structure, coenzyme form, biological role.
12. Vitamin B2: structure, coenzyme form, biological role.
13. Vitamin B12: structure, coenzyme form, biological role.
14. Folic acid: structure, biological role.
15. Nicotinic acid: structure, biological role.
16. Pantothenic acid: structure, biological role.
17. Vitamin C: structure, biological role.

GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.

1. General characteristics of carbohydrates: classification, structure of the main representatives, functions in the body.
2. Digestion and absorption of carbohydrates in monogastric animals.
3. Digestion and absorption of carbohydrates in polyhastric animals.
4. General characteristics of lipids: classification, structure of the main representatives, functions in the body.

5. Digestion and absorption of lipids in animals.

GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.

1. Blood plasma electrolytes – Na, K, Cl. Their biological role.
2. Blood plasma minerals - Ca, P, Mg. Their biological role.
3. Blood trace elements: Fe, Cu, Zn. Their role in metabolic processes.
4. Blood trace elements: Mn, Co, I, Se. Their role in metabolic processes.
5. Blood composition.
6. Respiratory function of the blood. The role of hemoglobin in the transport of gases.
7. Blood buffer systems, their role in the homeostasis of the animal body.
8. Plasma proteins are the main representatives and functions.
9. Bile: chemical composition, functions.
10. Pathological components of urine.
11. Chemical composition of connective tissue
12. Chemical composition and metabolism of bone tissue
13. Features of the biochemistry of muscle tissue.
14. The chemistry of muscle contraction.
15. The chemical composition of milk.
16. Biochemistry of nervous tissue.
17. Biochemistry of the egg.

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. Biochemistry is the purpose and objectives of the discipline.
2. The chain of biological oxidation. The role in energy metabolism.
3. Shortened chains of biological oxidation.
4. The structure and role of ATP. The main mechanisms of synthesis (substrate and oxidative phosphorylation).
5. Anaerobic glycolysis: reactions, biological role.
6. The Krebs cycle: reactions, role.
7. Gluconeogenesis: biological significance, reactions.
8. Glycogen metabolism: synthesis and decomposition; biological role.
9. The pentose phosphate pathway of glucose oxidation: reactions, biological role.
10. The concept of enzymes, their structure. Characteristics of the properties of enzymes.
11. Nomenclature and classification of enzymes. The enzyme cipher.
12. Factors affecting the rate of enzymatic reactions (temperature, pH, enzyme concentration, substrate concentration).
13. The importance of determining the activity of enzymes
14. The specificity of enzymes.

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

1. The structure of bile acids. The role of bile in the digestive process.
2. Synthesis of triglycerides in the intestinal wall.
3. Oxidation of fatty acids with an even number of carbon atoms.
4. Glycerol oxidation.
5. Synthesis of fatty acids.
6. General characteristics, biological significance and reactions of synthesis of ketone bodies.
7. Cholesterol: structure, synthesis, biological significance in the body of animals.
8. Phospholipids: structure, biological significance.
9. Digestion and absorption of proteins in monogastric animals.
10. Digestion and absorption of proteins in ruminants.

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. Putrefaction of amino acids in the intestine. Methods of neutralization of putrefaction products.
2. Transformation of amino acids in tissues: deamination of amino acids
3. Transformation of amino acids in tissues: transamination of amino acids
4. Amino acid conversion in tissues: decarboxylation of amino acids
5. Ketogenic and glucogenic amino acids
6. Urea cycle: reactions, biological significance.
7. Chromoproteins – examples, biological significance, heme structure.
8. Heme synthesis
9. Hemoglobin breakdown. Bilirubin metabolism.
10. Nucleoproteins – biological role. The structure of nucleotides.
11. Synthesis of purine nucleotides.
12. Synthesis of pyrimidine nucleotides.
13. The breakdown of purine nucleotides.
14. The breakdown of pyrimidine nucleotides.
15. Protein biosynthesis

3.2.3. List of exam question

GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body.

GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process.

1. General characteristics of hormones.
2. Hypothalamic hormones: structure, target cells, biological effects.
3. Pituitary hormones: structure, target cells, biological effects.
4. Thyroid hormones: structure, target cells, biological effects.
5. Parathyroid hormones: structure, target cells, biological effects.

6. Pancreatic hormones: structure, target cells, biological effects.
7. Characteristics of hormones of the adrenal medulla: structure, target cells, biological effects.
8. Hormones of the adrenal cortex: structure, target cells, biological effects.
9. Sex hormones: structure, target cells, biological effects
10. Humoral regulation of carbohydrate metabolism.
11. Humoral regulation of lipid metabolism.
12. Humoral regulation of protein metabolism.
13. Humoral regulation of metabolism of Ca and R.
14. Humoral regulation of water-salt metabolism in the body.
15. Hormones of the diffuse endocrine system
16. Hormonal activity of the thymus
17. Vitamin A: structure, biological role.
18. Vitamin D: structure, biological role.
19. Vitamin E: structure, biological role.
20. Vitamin K: structure, biological role.
21. Vitamin B1: structure, coenzyme form, biological role.
22. Vitamin B2: structure, coenzyme form, biological role.
23. Vitamin B12: structure, coenzyme form, biological role.
24. Folic acid: structure, biological role.
25. Nicotinic acid: structure, biological role.
26. Pantothenic acid: structure, biological role.
27. Vitamin C: structure, biological role.

GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.

1. General characteristics of carbohydrates: classification, structure of the main representatives, functions in the body.
2. Digestion and absorption of carbohydrates in monogastric animals.
3. Digestion and absorption of carbohydrates in polyhastric animals.
4. General characteristics of lipids: classification, structure of the main representatives, functions in the body.
5. Digestion and absorption of lipids in animals.

GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital technologies.

1. Blood plasma electrolytes – Na, K, Cl. Their biological role.
2. Blood plasma minerals - Ca, P, Mg. Their biological role.
3. Blood trace elements: Fe, Cu, Zn. Their role in metabolic processes.
4. Blood trace elements: Mn, Co, I, Se. Their role in metabolic processes.
5. Blood composition.
6. Respiratory function of the blood. The role of hemoglobin in the transport of gases.
7. Blood buffer systems, their role in the homeostasis of the animal body.
8. Features of the biochemistry of erythrocytes.
9. Features of the biochemistry of leukocytes and platelets.

10. Plasma proteins are the main representatives and functions.
11. Plasma enzymes are the main representatives, functions.
12. Nitrogen–free organic substances of blood plasma are the main representatives, biological role.
13. Nitrogen–containing non-protein substances of blood plasma are the main representatives, biological role.
14. The role of the liver in carbohydrate metabolism
15. The role of the liver in protein metabolism.
16. The role of the liver in lipid metabolism.
17. Mechanisms of xenobiotic inactivation in the liver.
18. Excretory function of the liver. Bile: chemical composition, functions.
19. Chemical composition and mechanisms of formation of primary and secondary urine.
20. Pathological components of urine.
21. Chemical composition of connective tissue
22. Chemical composition and metabolism of bone tissue
23. Features of the biochemistry of muscle tissue.
24. The chemistry of muscle contraction.
25. The chemical composition of milk.
26. Biochemistry of nervous tissue.
27. The chemistry of the origin and conduction of a nerve impulse
28. Biochemistry of the egg.

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. Biochemistry is the purpose and objectives of the discipline.
2. The chain of biological oxidation. The role in energy metabolism.
3. Shortened chains of biological oxidation.
4. The structure and role of ATP. The main mechanisms of synthesis (substrate and oxidative phosphorylation).
5. Anaerobic glycolysis: reactions, biological role.
6. The Krebs cycle: reactions, role.
7. Gluconeogenesis: biological significance, reactions.
8. Glycogen metabolism: synthesis and decomposition; biological role.
9. The pentose phosphate pathway of glucose oxidation: reactions, biological role.
10. The concept of enzymes, their structure.
11. Characteristics of the properties of enzymes.
12. Nomenclature and classification of enzymes. The enzyme cipher.
13. Factors affecting the rate of enzymatic reactions (temperature, pH, enzyme concentration, substrate concentration).
14. Activators and inhibitors of enzymes.

15. Allosteric regulation.
16. Isoenzymes.
17. The importance of determining the activity of enzymes
18. The specificity of enzymes.

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

1. The structure of bile acids. The role of bile in the digestive process.
2. Synthesis of triglycerides in the intestinal wall.
3. Oxidation of fatty acids with an even number of carbon atoms.
4. Glycerol oxidation.
5. Synthesis of fatty acids.
6. General characteristics, biological significance and reactions of synthesis of ketone bodies.
7. Cholesterol: structure, synthesis, biological significance in the body of animals.
8. Phospholipids: structure, biological significance.
9. Synthesis of phospholipids based on choline.
10. Synthesis of phospholipids without choline.
11. Digestion and absorption of proteins in monogastric animals.
12. Digestion and absorption of proteins in ruminants.

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. Putrefaction of amino acids in the intestine. Methods of neutralization of putrefaction products.
2. Transformation of amino acids in tissues: deamination of amino acids
3. Transformation of amino acids in tissues: transamination of amino acids
4. Amino acid conversion in tissues: decarboxylation of amino acids
5. Ketogenic and glucogenic amino acids
6. Urea cycle: reactions, biological significance.
7. Chromoproteins – examples, biological significance, heme structure.
8. Heme synthesis
9. Hemoglobin breakdown. Bilirubin metabolism.
10. Nucleoproteins – biological role. The structure of nucleotides.
11. Synthesis of purine nucleotides.
12. Synthesis of pyrimidine nucleotides.
13. The breakdown of purine nucleotides.
14. The breakdown of pyrimidine nucleotides.
15. Protein biosynthesis

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.

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

1.5.

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.

Program abstract of the discipline B1.O.16 «Biological chemistry»
specialty 36.05.01 Veterinary Medicine
Profile: «General clinical veterinary medicine»

The purpose of the development of the discipline: Acquisition of knowledge by students about the laws of the chemical composition, structure and properties of components of the animal organism; acquisition of students' knowledge about the chemical composition, structure and properties of components of the animal organism, the metabolism and energy, the relationship of metabolism of various substances.

In order to achieve this goal, it is necessary to:

a) The general educational task is to familiarize students with the laws of the chemical composition and metabolism of the animal body and gives a fundamental biological education in accordance with the requirements, applied to higher educational institutions of biological profile.

b) The application addresses issues related to dynamic biochemistry and provides a conceptual framework for the implementation of interdisciplinary structural and logical linkages for the development of medical thinking.

c) A special task is to acquaint students with the modern directions and methodological approaches used in biochemistry to solve the problems of animal husbandry and veterinary medicine, as well as with the achievements in this area.

The place of discipline in the study plan: discipline «Biological chemistry» B1.O.16 refers to the obligatory part of disciplines of the federal state educational standard of higher education in the specialty 36.05.01 Veterinary Medicine.

Discipline «Biological chemistry» is mastered by: Full-time education in 3rd, 4th semesters;

When teaching the discipline «Biological chemistry» the knowledge and skills acquired by students in the development of disciplines are used: biological physics, inorganic and analytical chemistry, biology with the basics of ecology, organic, physical and colloid chemistry, Animal anatomy, cytology, histology and embryology, physiology and ethology of animals.

Requirements to the results of the development of the discipline: as a result of the development of the discipline the following competencies are formed:

GPC-1. Is able to determine the biological status, normal clinical signs of organs and systems of the animal body.

GPC-1 ID-1 To know: safety precautions and personal hygiene rules during the examination of animals, methods of its fixation; schemes of clinical examination of an animal and the procedure for examination individual body systems; methodology for diagnosis of the pathological process

GPC-1 ID-2 To be able to: collect and analyze anamnesis data, conduct laboratory and functional studies, necessary to determine the animal biological status.

GPC-1 ID-3 To possess practical skills: for conducting on its own a clinical examination of an animal, using classical research methods and digital 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-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.

Short content of the discipline: as a result of mastering the discipline, the student will study such sections of the discipline as a subject of biological chemistry, its importance for biology, medicine, veterinary medicine, agricultural production, veterinary biotechnology and other fields of science and economy, brief history of biological chemistry, role of domestic scientists in its

development, energy metabolism, macro-commercial compounds. Carbohydrate exchange, lipid exchange and protein exchange were studied. Such topics as blood biochemistry, hormone biochemistry and biochemical features of individual organs and systems have been mastered.

The total labor intensity of the discipline is: 6 credits, 216 academic hours.

Final control of discipline: test, exam.