Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
higher education
"St. Petersburg State University of Veterinary Medicine"

APPROVED BY
Vice-Rector
for educational work
and youth policy
Professor
_____ A.A. Sukhinin
June 27, 2025

Department of Inorganic Chemistry and Biophysics

WORKING PROGRAMM

by discipline

"INORGANIC CHEMISTRY"

Level of higher education

SPECIALTY

Specialty 36.05.01 Veterinary Medicine

Profile: «General clinical veterinary medicine»

Full-time education

Education starts in 2025

Reviewed and accepted
at a department meeting
June 19, 2025
Protocol No. 18-06-24/25

Head department of
Inorganic Chemistry and Biophysics
Candidate of Chemical Sciences, Associate Professor
_____ A.N. Baryshev

Saint Petersburg
2025

1. GOALS AND OBJECTIVES OF THE DISCIPLINE

The main goal of the discipline in the training of veterinarians is to give students fundamental knowledge about chemicals to assess the possibility of their effective use in animal therapy and surgery.

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

a) The general educational task is to in-depth familiarize students with the main chemical substances used in veterinary medicine, their properties and methods of production, which meets the requirements for higher educational institutions of biological profile.

b) The applied task concerns the acquisition of skills in conducting chemical experiments and reactions, including the identification of inorganic substances used as veterinary medicine.

c) The special task is to familiarize students with modern trends and methodological approaches used in inorganic and analytical chemistry, as well as existing achievements in this area.

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

As a result of mastering the discipline, the student prepares for the following types of activities in accordance with the educational standard of Federal State Educational Standard of Higher Education 36.05.01 “Veterinary Medicine”.

Area of professional activity:

13 Agriculture

Types of professional activity tasks:

- medical;
- expert control;
- scientific and educational.

Student competencies formed as a result of mastering the discipline

Studying the discipline should form the following competencies:

A) Universal Competencies (UC):

UC-1 Able to critically analyze problem situations based on a systematic approach and develop an action strategy:

UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis;

UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies;

UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations.

B) General professional competencies (GPC):

GPC-4Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results:

GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity;

GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained;

GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.

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

Discipline B1.O.14.01 “Inorganic Chemistry” is a mandatory discipline in Block 1 of the mandatory part of the federal state educational standard of higher education in specialty 36.05.01 “Veterinary Medicine” (specialty level).

Mastered in the 1st semester - full-time.

When teaching the discipline “Inorganic Chemistry”, the knowledge and skills acquired by students while mastering the school level of chemistry are used. The discipline “Inorganic and Analytical Chemistry” is the basic one on which most subsequent disciplines are built, such as:

1) Organic and physical colloid chemistry.
2) Biological chemistry.
3) Veterinary microbiology and mycology.
4) Veterinary pharmacology.
5) Toxicology.
6) Physiology and ethology of animals.
7) Feeding animals with the basics of feed production.
8) Veterinary and sanitary examination.
9) Life safety.

4. SCOPE OF THE DISCIPLINE “INORGANIC CHEMISTRY”

4.1. Scope of the discipline “Inorganic Chemistry” for full-time study

Type of educational work	Total hours	Semester
		1
Classroom lessons (total)	**72**	**72**
Including:		
Lectures, including interactive forms	18	18
Practical lessons (PL), including interactive forms, of which:	18	18
practical training (PT)	4	4
Independent work (total)	**18**	**18**
Control	**18**	**18**
Type of intermediate certification (test, exam)	**Exam**	**Exam**
Total labor intensity hours/credits	**72/2**	**72/2**

5. CONTENT OF THE DISCIPLINE "INORGANIC CHEMISTRY"

5.1. Contents of the discipline "Inorganicchemistry" for full-time study

NO.	Name	Formed competencies	Semester	Types of educational work, including independent work of students and labor intensity (in hours)			
				L	PL	PT	IW
1.	Introduction. Fundamentals of chemical nomenclature and quantitative relationships. The structure of the atom. Periodic law D.I. Mendeleev	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	1	4	2		4

2.	Chemical bond. Chemical thermodynamics. Kinetics and equilibrium of chemical processes.	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	1	2	2		2
3.	Hydrogen. Halogens. Elements of the oxygen subgroup.	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	1	2	2		2

4.	Subgroup of carbon. Cyanides. Nitrogen subgroup. Phosphorus, arsenic and their compounds.	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	1	2	2		2
5.	Redox reactions.	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	1	4	2	4	4

6.	Elements of side subgroups. Manganese. Chromium and its compounds.	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	1	2	2		2
7.	Iron triad (iron, cobalt, nickel). Biological role of micro- and macroelements.	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	1	2	2		2
		TOTAL FOR 1 SEMESTER		**18**	**14**	**4**	**18**

6. LIST OF EDUCATIONAL AND METHODOLOGICAL SUPPORT FOR INDEPENDENT WORK OF STUDENTS

6.1.Guidelines for independent work

1. Workbook on inorganic and analytical chemistry: educational method. manual for 1st year students of the Faculty. vet. honey. and vet.-san. fak., for fak. vet. honey. part-time (evening) form of education / A. N. Baryshev [and others]; SPbGAVM. - 4th ed., revised. and additional - St. Petersburg: SPbGAVM, 2017. - 112 p. - URL:https://clck.ru/VWM86(access date: 04/27/2024). - Access mode: for authorization. users of the SPbSUVM EB. – Text: electronic.

6.2.Literature for independent work

1. Workshop on inorganic chemistry: for students. 1st year FVM, VSE, BEC, VBRIA / comp. P. M. Sargaev and others; SPbGAVM. - St. Petersburg. : Publishing house SPbGAVM, 2016. - 49 p.

2. Workshop on inorganic chemistry: for students. 1st year FVM, VSE, BEC, VBRiA / Sargaev Pavel Markelovich [etc.]; P. M. Sargaev [and others]; SPbGAVM. - Ed. 8th, revised and additional - St. Petersburg: Publishing house SPbGAVM, 2016. – 49 p. URL:https://clck.ru/R6y9p(access date: 04/27/2024). - Access mode: for authorization. users of the SPbSUVM EB. – Text: electronic.

7. LIST OF BASIC AND ADDITIONAL LITERATURE REQUIRED FOR MASTERING THE DISCIPLINE

a) basic literature:

1. General chemistry. Basic level = General chemistry. Basic level : textbook / G. V. Solovyova, O. A. Nevolina, T. S. Berseneva, I. A. Mustaeva ; English translation by T. S. Berseneva ; scientific editor V. V. Vaitner ; Ministry of Education and Science of the Russian Federation, Ural Federal University named after the first President of Russia B.N. Yeltsin. Yekaterinburg : Ural University Press, 2017. 182, [2] p. — Parallel title Russian, English. — The text is parallel to Russian and English. — ISBN 978-5-7996-1991-6.

2.. Chemistry [Electronic resource] : textbook and practice. a manual on teaching reading in English / author-comp. N. K. Yashina; Vladimir State University named after A. G. and N. G. Stoletov. – Vladimir : Publishing House of the All-Russian State University, 2024. – 115 p. – ISBN 978-5-9984-1928-7. – Electronic data. (1.24 Mb). – 1 electronic optical disc (DVD-ROM). – Systems. Requirements: Intel from 1.3 GHz ; Windows XP/7/8/10 ; Adobe Reader ; DVD-ROM drive. – Title page. the screen.

b) additional literature:

1. Kim, N. E., General and inorganic chemistry for medical specialties : a textbook / N. E. Kim, N. O. Kim, E. Y. Chernova. — Moscow : KnoRus, 2026. — 191 p. — ISBN 978-5-406-15470-0. — URL: https://book.ru/book/960507 (date of request: 19.06.2025). — Text : electronic.

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

To prepare for practical classes and perform independent work, students can use the following Internet resources:

1. https://meduniver.com – Medical information site.
2. http://vanat.cvm.umn.edu– Inorganic and Analytical Chemistry University of Minnesota

Electronic library systems:

1. EBS "SPBGUVM"
2. Legal reference system "ConsultantPlus"
3. University information system "RUSSIA"
4. Full text database POLPRED.COM
5. Scientific electronic library ELIBRARY.RU
6. Russian Scientific Network
7. Electronic library system IQlib
8. Full-text interdisciplinary database for agricultural and environmental sciencesProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE
9. Electronic books from the publishing house "Prospekt Nauki"http://prospektnauki.ru/ebooks/
10. Collection “Agriculture. Veterinary" publishing house "Kvadro"https://elibrica.com/

9. METHODOLOGICAL INSTRUCTIONS FOR STUDENTS ON MASTERING THE DISCIPLINE

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

- Tips for planning and organizing the time needed to study the discipline. Description of the sequence of student actions, or “scenario for studying the discipline.”

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

- Recommendations for working on lecture material

When preparing for a lecture, the student is recommended to:

1) review the recordings of the previous lecture and recall previously studied material in memory;

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

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

4) prepare yourself psychologically for the lecture.

This work includes two main stages: taking notes of lectures and subsequent work on lecture material.

Note-taking means drawing up notes, i.e. a brief written statement of the content of something (oral presentation - speech, lecture, report, etc. or a written source - document, article, book, etc.).

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

By taking notes from written sources, the student has the opportunity to repeatedly read the desired passage of 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. While listening to a lecture, the student must put off most of the above-mentioned work 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 from a lecture, it is recommended to separate fields on each page for subsequent entries in addition to the notes.

After recording a lecture or taking notes, you should not leave work on the lecture material until you begin preparing for the test. It is necessary to do as early as possible the work that accompanies note-taking of written sources and which was not possible to do while recording the

lecture - read your notes, deciphering individual abbreviations, analyze the text, establish logical connections between its elements, in some cases show them graphically, highlight main thoughts, note issues that require additional processing, in particular, teacher consultation.

When working on the text of a lecture, the student needs to pay special attention to the problematic questions posed by the teacher when giving the lecture, as well as to his assignments and recommendations.

For each lecture, practical lesson and laboratory work, the number, topic, list of issues covered, volume in hours and links to recommended literature are provided. For classes conducted in interactive forms, their organizational form must be indicated: computer simulation, business or role-playing game, analysis of a specific situation, etc.

- Recommendations for preparing for practical classes

Practical (seminar) classes constitute an important part of students' professional training. The main goal of conducting practical (seminar) classes is to develop analytical, creative thinking in students by acquiring practical skills. Practical classes are also conducted with the aim of deepening and consolidating the knowledge gained at lectures and in the process of independent work on regulatory documents, educational and scientific literature. When preparing for a practical lesson for students, it is necessary to study or repeat theoretical material on a given topic.

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

1) familiarize yourself with the plan for the upcoming lesson;

2) study the literature sources that were recommended and read the introductory notes to the relevant sections.

Methodological instructions 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 curriculum of the disciplines in the sections "List of topics for practical (seminar) classes."

The most important component of any form of practical training is assignments. The basis of the assignment is an example, which is analyzed from the perspective of the theory developed in the lecture. As a rule, the main attention is paid to the formation of specific skills and abilities, which determines the content of students' activities - problem solving, laboratory work, clarification of the 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 attention to the lecture course;
- consolidate the knowledge gained in the process of lecture training and independent work on literature;
- expand the scope of professionally significant knowledge, skills and abilities;
- allow you to check the correctness of previously acquired knowledge;
- instill skills of independent thinking and oral presentation;
- promote free use of terminology;
- provide the teacher with the opportunity to systematically monitor the level of students' independent work.

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

- Recommendations for working with literature.

Working with literature is an important stage of a student's independent work in mastering a subject, contributing not only to consolidation of knowledge, but also to broadening his horizons, mental abilities, memory, ability to think, present and confirm his hypotheses and ideas. In addition, research skills necessary for future professional activities are developed.

When starting to study literature on a topic, it is necessary to make notes, extracts, and notes. It is imperative to take notes on the works of theorists, which allow one to comprehend the theoretical basis of the study. For the rest, you can limit yourself to extracts from studied sources. All extracts and quotations must have an exact "return address" (author, title of work, year of publication, page, etc.). It is advisable to write an abbreviated name of the question to which the extract or quotation relates. In addition, it is necessary to learn how to immediately compile a card index of specialized 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, and abstract journals. In this case, publications of sources (articles, book titles, etc.) should be written on separate cards, which must be filled out in accordance with the rules of bibliographic description (surname, initials of the author, title of work. Place of publication, publisher, year of publication, number of pages, and for journals articles – journal name, 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 further 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 contents, structure, what sources it was written on, etc.

• Explanations about working with test materials for the course, recommendations for completing homework.

Testing is a check that allows you to determine whether the actual behavior of a program corresponds to what is expected if you run a specially selected set of tests. A test is the fulfillment of certain conditions and actions necessary to verify the operation of the function being tested or its part. Each question in the discipline must be answered correctly by choosing one option.

• Recommendations for completing course work (if it is included in the curriculum), defining their thematic focus, goals and objectives of implementation, requirements for content, volume, design and organization of management of their preparation on the part of departments and teachers.

10. EDUCATIONAL 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, moral, civil and patriotic values, a system of aesthetic and ethical knowledge and values, attitudes of tolerant consciousness in society, the formation in students of the need to work as the first vital necessity, the highest value and the main way to achieve success in life, to understand the social significance of your future profession.

11. LIST OF INFORMATION TECHNOLOGIES USED IN THE EDUCATIONAL PROCESS

11.1 The educational process in the discipline provides for the use of information technologies:

✓ conducting practical classes using multimedia;

✓ interactive technologies (conducting dialogues, collective discussion of various approaches to solving a particular educational and professional problem);

✓ interaction with students via email;

✓ joint work in the Electronic Information and Educational Environment of St. Petersburg State University of Mathematics and Mathematics: https://spbguvm.ru/academy/eios/

11.2. Software

List of licensed and freely distributed software, including domestically produced ones

No.	Name of technical and computer training aids recommended by sections and topics of the program	License
1	MS PowerPoint	67580828
2	LibreOffice	free software

3	OS Alt Education 8	AAO.0022.00
4	ABIS "MARK-SQL"	02102014155
5	MS Windows 10	67580828
6	System ConsultantPlus	503/KL
7	Android OS	free software

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

Name of the discipline (module), practice in accordance with the curriculum	**Name of special premises and premises for independent work**	**Equipping special rooms and rooms for independent work**
Inorganic chemistry	104 (196084, St. Petersburg, Chernigovskaya str., building 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:*desks, chairs, blackboard. *Visual aids and educational materials:*Periodic table of chemical elements D.I. Periodic table, Solubility table
	105 (196084, St. Petersburg, Chernigovskaya str., building 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:*desks, chairs, blackboard. *Visual aids and educational materials:*Periodic table of chemical elements D.I. Periodic table, Solubility table
	206 Large reading room (196084, St. Petersburg, Chernigovskaya str., building 5) Room for independent work	*Specialized furniture*: tables, chairs *Technical training aids:*computers with an Internet connection and access to the electronic information and educational environment
	214 Small reading room (196084, St. Petersburg, Chernigovskaya str., building 5) Room for independent work	*Specialized furniture:*tables, chairs *Technical training aids:*computers with an Internet connection and access to the electronic information and educational environment
	324 Department of Information Technologies (196084, St. Petersburg, Chernigovskaya str., building 5) Room for storage and preventive maintenance of educational equipment	*Specialized furniture:*tables, chairs, special equipment, materials and spare parts for preventive maintenance of educational equipment
	Box No. 3 Carpentry workshop (196084, St. Petersburg, Chernigovskaya str., building 5) Room for storage and preventive maintenance of educational equipment	*Specialized furniture:*tables, chairs, special equipment, materials for preventive maintenance of specialized furniture

Developer:
Candidate of Chemical Sciences, Associate Professor **A.N. Baryshev**

Annex 1

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution of
higher education
"St. Petersburg State University of Veterinary Medicine"

Department of Inorganic Chemistry and Biophysics

FUND OF ASSESMENT TOOLS
for the discipline

for discipline

"INORGANIC CHEMISTRY "
Level of higher education
SPECIALTY
Specialty 36.05.01 Veterinary Medicine
Profile: «General clinical veterinary medicine»
Full-time education

Education starts in 2025

Saint Petersburg
2025

1. PASSPORT OF THE ASSESSMENT FUND

Table 1

No.	Molded competencies	Controlled sections (topics) disciplines	Evaluation tool
1.	**UC-1**Able to critically analyze problem situations based on a systematic approach and develop an action strategy: UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis; UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies; UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations. **GPC-4** Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results: GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity; GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained; GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	Introduction. Fundamentals of chemical nomenclature and quantitative relationships. The structure of the atom. Periodic law D.I. Mendeleev	Colloquium, tests, test
2.		Chemical bond. Chemical thermodynamics. Kinetics and equilibrium of chemical processes.	Colloquium, tests, test
3.		Hydrogen. Halogens. Elements of the oxygen subgroup.	Colloquium, tests
4.		Subgroup of carbon. Cyanides. Nitrogen subgroup. Phosphorus, arsenic and their compounds.	Colloquium, tests
5.		Redox reactions.	Colloquium, tests
6.		Elements of side subgroups. Manganese. Chromium and its compounds.	Colloquium, tests
7.		Iron triad (iron, cobalt, nickel). Biological role of micro- and macroelements.	Colloquium, tests

2. Approximate list of assessment tools

table 2

No.	Name evaluation tool	Brief description of the evaluation tool	Presentation of the assessment tool in the fund
1.	Colloquium	A means of monitoring the assimilation of educational material of a topic, section or sections of a discipline, organized as a training session 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 measuring the level of knowledge and skills of the student	Test task fund
3.	Test	A means of monitoring the assimilation of educational material of a topic, section or sections of a discipline, organized as a training session in the form of a written answer to questions on the material being studied	Sample version of the test paper

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

Table 3

Planned results of mastering the competency	Mastery level				Evaluation tool
	unsatisfactory	satisfactorily	Fine	Great	
UC-1 Able to critically analyze problem situations based on a systematic approach and develop an action strategy:					
UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis;	Knowledge level below minimum requirements, had the place is rude errors	Minimum acceptable knowledge level, a lot was allowed minor mistakes	Level of knowledge in volume, appropriate program preparation, admitted a few rough ones errors	Level of knowledge in volume, appropriate program preparation, without errors.	Colloquium, tests, test
UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies;	When deciding standard tasks Not basic skills demonstrated, there were rough errors	The main skills, solved typical tasks with not rude mistakes, all completed tasks, but not in in full	All the main ones are demonstrated skills, all solved main tasks with not rude mistakes, all completed assignments in full volume, but some with shortcomings	All the main ones are demonstrated skills, all solved main tasks with separate insignificant shortcomings, all completed assignments in full volume	Colloquium, tests, test
UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to	When deciding standard tasks Not demonstrated basic skills there were rough	Available minimum set skills for solutions standard tasks with some	Basic skills demonstrated when deciding standard tasks with some shortcomings	Demonstrated skills in decision non-standard tasks without errors and	Colloquium, tests, test

solve them; demonstrating value judgments in solving problematic professional situations.	errors	shortcomings		shortcomings	
GPC-4 Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results:					
GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity;	Knowledge level below minimum requirements, had the place is rude errors	Minimum acceptable knowledge level, a lot was allowed minor mistakes	Level of knowledge in volume, appropriate program preparation, admitted a few rough ones errors	Level of knowledge in volume, appropriate program preparation, without errors.	Colloquium, tests, test
GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained;	When deciding standard tasks Not basic skills demonstrated, there were rough errors	The main skills, solved typical tasks with not rude mistakes, all completed tasks, but not in in full	All the main ones are demonstrated skills, all solved main tasks with not rude mistakes, all completed assignments in full volume, but some with shortcomings	All the main ones are demonstrated skills, all solved main tasks with separate insignificant shortcomings, all completed assignments in full volume	Colloquium, tests, test
GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.	When deciding standard tasks Not demonstrated basic skills there were rough errors	Available minimum set skills for solutions standard tasks with some shortcomings	Basic skills demonstrated when deciding standard tasks with some shortcomings	Demonstrated skills in decision non-standard tasks without errors and shortcomings	Colloquium, tests, test

4. LIST OF CHECK TASKS AND OTHER MATERIALS REQUIRED FOR THE ASSESSMENT OF KNOWLEDGE, ABILITIES, SKILLS AND ACTIVITY EXPERIENCE

4.1. Typical tasks for ongoing progress monitoring

4.1.1. Questions for the colloquium

Competency assessment questions:

UC-1 Able to critically analyze problem situations based on a systematic approach and develop an action strategy:

UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis;

1. Equivalent mass. Equivalent volume (give examples). Law of equivalents.
2. Examples of calculating the equivalent of an element, oxide, base, acid, salt, oxidizing agent, reducing agent.
3. The structure of the atom.
4. Periodic system and periodic law D.I. Mendeleev.
5. Modern model of the state of an electron in an atom. Quantum numbers. Pauli's principle.
6. Distribution of electrons in an atom. Hund's rule.
7. Periodic law from the point of view of atomic structure. Reasons for periodicity.
8. s, p, d, f -elements, position in the periodic table. Basic chemical properties.
9. The nature of the chemical bond. Valence bond method.
10. Exchange and donor-acceptor mechanisms of covalent bond formation.
11. Covalent bond. Its varieties and properties.
12. Valence of atoms in stationary and excited states. Multiplicity of communication. Sigma bond and pi bond.
13. Hybridization of atomic orbitals. Examples. Spatial configuration of molecules with sp, sp2, sp3 hybridization (examples).
14. Ionic bond. Non-directionality and unsaturation of ionic bonds. Properties of substances with ionic bonding.
15. Types of intermolecular interactions.
16. Hydrogen bond, its biological role.

UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies;

17. Basic thermodynamic characteristics. 1st, 2nd and 3rd laws of chemical thermodynamics.
18. Gibbs energy. The direction of spontaneous chemical processes.
19. Thermochemical law of Hess. Thermal effect of the reaction.
20. The rate of a chemical reaction. Law of mass action (kinetic).
21. Dependence of the rate of a chemical reaction on temperature. Temperature coefficient. Van't Hoff's law. Activation theory.

22. The phenomenon of catalysis. Catalysts, principle of operation. Theory of transition state and formation of activated complexes. Biocatalysts.
23. Chemical equilibrium from the point of view of thermodynamics. Equilibrium constant.
24. Shift in chemical equilibrium. Le Chatelier's principle.

UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations.

25. Aggregate states. Solutions: Concept, theory. Solutions are saturated, unsaturated, supersaturated.
26. Methods of expressing the concentration of solutions.
27. Osmosis. Van't Hoff's law. The role of osmosis in biological phenomena.
28. The vapor pressure of the solvent above the solution. Raoult's law.
29. Boiling and freezing of solutions.
30. Deviation of behavior of electrolyte solutions from non-electrolytes. Isotonic coefficient.
31. Weak electrolytes. Degree of dissociation. Dissociation constant.
32. Dependence of the degree of dissociation of a weak electrolyte on the concentration of the solution. Ostwald's law of dilution.
33. Equilibrium in solutions of weak electrolytes. Influence of the same and binding ions.
34. Amphoteric hydroxides from the point of view of the theory of electrolytic dissociation.
35. Strong electrolytes. Active concentration. Ionic strength of the solution.
36. Dissociation of water. Ionic product of water. Hydrogen pH indicator.
37. Hydrolysis of salts. Role in a living organism.
38. Complex connections. Werner's theory. Role in a living organism.
39. Dissociation of complex compounds. Instability constant of complex ions.

Competency assessment questions:

GPC-4Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results:

GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity;

40. General characteristics of the halogen subgroup.
41. Methods for producing halogens. Application.
42. Hydrogen compounds of halogens. Properties, application.
43. Chlorine water. Preparation, properties, application.
44. Bleaching powder. Preparation, properties, application.
45. Oxygen-containing acids of halogens. Changes in their strength and oxidative capacity. Salts of oxygen-containing acids. Application.
46. General characteristics of the oxygen subgroup.

47. Water. Physical and chemical properties. Water as a solvent. Biological role of water.
48. Hydrogen sulfide, preparation and properties. Hydrogen sulfide acid. 1st and 2nd dissociation constants. Role in redox processes. Salts of hydrosulfide acid.
49. Sulfuric acid. Role in redox processes. Salts of sulfuric acid. Application.
50. Sulfur compounds in oxidation state +4. Role in redox processes (examples). Application.

GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained;

51. General characteristics of the elements of the carbon subgroup. Effect on a living organism. Application.
52. Oxygen-containing carbon compounds. Cyanides.
53. Silicon, atomic structure. The most important compounds, their properties, applications.
54. General characteristics of the nitrogen subgroup.
55. Ammonia. Preparation, chemical properties, application.
56. Nitric acid. Chemical properties. Interaction with metals. Nitrates. Detection.
57. Nitrous acid and its salts. Role in redox processes. Application.
58. Biological role of nitrogen and phosphorus. Application.
59. Arsenic and its compounds. Detection. Effect on a living organism. Application.

GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.

60. Redox reactions. Types of redox reactions.
61. The most important oxidizing and reducing agents. Redox duality.
62. Standard electrode potentials. Direction of redox reactions.
63. Chromium. The structure of the atom. Possible oxidation states. Acid-base properties. Application.
64. Redox properties of chromium compounds with varying degrees of oxidation.
65. Amphotericity of chromium(III) hydroxide. Chromites, their reducing properties.
66. Chromic and dichromic acids, their salts, role in redox reactions.
67. Manganese. The structure of the atom. Possible oxidation states. Acid-base properties.
68. Redox properties of manganese compounds depending on the degree of oxidation.
69. Behavior of potassium permanganate in various environments (examples). Application.
70. General characteristics of the iron triad. Role in a living organism.
71. Iron, atomic structure, oxidation states. Changes in the properties of compounds with changes in the oxidation state of iron. Role in a living organism. Application.

4.1.2 Test topics

UC-1 Able to critically analyze problem situations based on a systematic approach and develop an action strategy:

UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis;

UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies;

UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations.

GPC-4 Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results:

GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity;

GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained;

GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.

CLOSED TYPE TASKS

Tasks of a combined type with the choice of one correct answer from the proposed options

UC-1.1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis;

Task 1.
Read the task and choose the correct answer.
What quantum number characterizes the direction of the electron cloud in space?
1) n 2) l
3) ml 4) ms
Write down the number under which the correct answer is indicated.
Answer: 3

Task 2.
Read the task and choose the correct answer.
Atoms of which element have an outer shell electron configuration of 4s24p5?
1) 35Br 2) 7N
3) 33As 4) 23V
Write down the number under which the correct answer is indicated.
Answer: 3

Task 3.
Read the task and choose the correct answer.
What is the general formula for the base?
1) Me(OH)y 3) H2(Ac)

3) EmOn 4) Mech(Ace)u
Write down the number under which the correct answer is indicated.
Answer: 1

Tasks of a combined type with a choice of several correct answers from the proposed options

Task 4.
Read the task, choose the correct answers.
Which acids are dibasic?
1) H3PO3 2) HB2
3) HNO3 4) H2CO3
Write down the numbers under which the correct answers are indicated.
Answer: 14

Task 5.
Read the task, choose the correct answers.
Which of the following substances dissolve in water?
1) AgBr 2) Cu(OH)2
3) Zn(NO3)2 4) HgCl2
Write down the numbers under which the correct answers are indicated.
Answer: 34

UC-1.2 Able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific problems related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies;

Closed-ended tasks to establish compliance

Task 6.
Read the task and match.
Match an element with its application

Elements		**Application**	
A	Chlorine	1	Tissue mineralization
B	Lithium	2	Lighting
IN	Calcium	3	Batteries
G	Neon	4	Disinfection of water and surfaces
		5	Welding

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A4B3B1G2

Task 7.

Read the task and match.

Match a connection to the class it belongs to

Compound		**Class**	
A	HNO3	1	Basic hydroxide
B	Fe(OH)2	2	Salt
IN	Fe(OH)NO3	3	Oxide
G	NaNO3	4	Acid
		5	Amphoteric hydroxide

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A4B1B2G2

Task 8.

Read the task and match.

Establish a correspondence between the complex compound and the coordination number of the central ion

Complex connection		**Coord. number**	
A	[Cu(NH3)4]SO4	1	3
B	Na3[Co(NO2)6]	2	4
IN	H[AuCl4]	3	2
G	[Ag(NH3)2]OH	4	6

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A3B4B2G3

Task 9.
Read the task and match.
Match the scientist with his contribution to the development of chemistry

Scientist		**Contribution**	
A	Peter Waage	1	Calculation and application of free energy
B	Josiah Gibbs	2	Theory of electrolytic dissociation
IN	Joseph Thomson	3	Law of mass action
G	Svante Arrhenius	4	The nature of electrons
		5	Description of entropy

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A3B1B4G2

Task 10.
Read the task and match.
Match an ion with a quality reagent for its detection.

Ions		**Reagent**	
A	Ba2+	1	HNO3
B	Ag+	2	Soluble bases
IN	Fe3+	3	(NH4)2S
G	Mn2+	4	HCl
		5	H2SO4

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A5B4B2G3

Closed-ended tasks to establish a sequence

Task 11.
Read the task and establish the sequence.
Arrange the following elements in order of increasing electronegativity
1. Li
2. Ba
3. P
4. Cl
Answer: 2134

Task 12.
Read the task and establish the sequence.
Arrange the following acidic residues in order of increasing oxidizing strength.
1. Cl-
2. ClO4-
3. ClO3-
4. ClO2-
Answer: 1432

UC-1.3 Has the ability to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identify problems and use adequate methods to solve them; demonstrate value judgments in solving problematic professional situations.

Task 13.
Read the task and establish the sequence.
Place scientific discoveries in chronological order
1. Creation of galvanic cells
2. Law of conservation of energy
3. Discovery of hydrogen
4. Methods of nuclear fission
Answer: 3124

Task 14.
Read the task and establish the sequence.
Arrange the elements in order of increasing valence electrons on the outer electron shell.
1. S**;
2. S+6
3. S*;
4. S0.
Answer: 2431

Task 15.
Read the task and establish the sequence.
When the chromium compound was placed in an acidic medium, the solution turned orange. Then, when the solution was neutralized and the following reaction was carried out, a green precipitate was obtained. By adding alkali, the precipitate was dissolved and a stable emerald solution was obtained. List the chromium compounds in the order they were mentioned.
1. Cr(OH)3
2. CrO42-;
3. Cr2O72-;

4. [Cr(OH)6]3-.
Answer: 2314

OPEN-TYPE TASKS

Task 16.
Read the task and give a reasoned answer.
How will the entropy change in the reaction:

$$N2(g) + 3H2(g) \leftrightarrow 2NH3(g)$$

Give an explanation for your answer. Will this process occur spontaneously?

Answer: In this reaction, the entropy of the system decreases, because the number of gas molecules decreases. Random occurrence of the process is statistically unlikely.

Task 17.
Read the task and give a reasoned answer..
Indicate which of the chemical elements: Li, Fe, Mg, Na, has the most pronounced metallic properties? Based on what characteristics of the element can metallic properties be assumed?
Answer: Na. Metallic properties are indicated by a large atomic radius, low electronegativity and ionization energy.

Task 18.
Read the task and give a reasoned answer..
Determine whether the amount of nitrogen (III) fluoride will increase with increasing pressure in the system:
$6HF (g) + N2 (g) \rightleftarrows 2NF3 (g) + 3H2 (g) - Q$
Answer: In a reversible process, increasing pressure shifts the equilibrium toward the least amount of gaseous substances. In this case, with increasing pressure, the amount of nitrogen fluoride will decrease.

Task 19.
Read the task and give a reasoned answer..
What mass of potassium hydroxide must be dissolved in 300 ml of water to obtain a 15% solution? What ratio does the indicated concentration express?
Answer: It is customary to indicate the mass fraction in percentages, expressing the ratio between the mass of the dissolved substance and the mass of the solution. Having composed the equation of this ratio, we obtain the required mass of hydroxide - 52.9 g.

Task 20.
Read the text and give a detailed, reasoned answer.
How are active metals of the first group obtained in industry? What is the rationale for using the chosen method?
Answer: Alkali metals are obtained in industry by electrolysis of salt melts. This method is used because it is practically impossible to obtain simple substances of the first group elements from solutions.

GPC-4 Capable of using in professional activities methods of solving problems using modern equipment in the development of new technologies and using modern professional methodology to conduct experimental research and interpret its results:
GPC-4.1 Knows the technical capabilities of modern specialized equipment, methods for solving problems of professional activity;
GPC-4.2 Able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained;
GPC-4.3 Possesses skills in working with specialized equipment to implement assigned tasks during research and development of new technologies, including digital ones.

CLOSED TYPE TASKS

Tasks of a combined type with the choice of one correct answer from the proposed options

GPC-4.1 Knows the technical capabilities of modern specialized equipment, methods for solving problems of professional activity;

Task 21.
Read the task and choose the correct answer.
Isotopes of a chemical element differ from each other:
1) by the number of neutrons 3) by the number of electrons
3) by the number of protons 4) by position in the periodic table
Write down the number under which the correct answer is indicated.
Answer: 1

Task 22.
Read the task and choose the correct answer.
Solutions of which salts are characterized by pH values > 7?
1) NaBr 2) AgNO3
3) FeCl3 4) MgSO3
Write down the number under which the correct answer is indicated.
Answer: 4

Task 23.
Read the task and choose the correct answer.
How is the sublevel designated for which n = 4 and l = 0?
1) 4*f* 2) 4d
3) 4p 4) 4s
Write down the number under which the correct answer is indicated.
Answer: 4

Tasks of a combined type with a choice of several correct answers from the proposed options

Task 24.
Read the task, choose the correct answers.
Which substances in the ionic equation of the following reaction of lead nitrate with hydrogen sulfide are written as molecules?
1) H2S 3) Pb(NO3)2
2) PbS 4) HNO3
Write down the numbers under which the correct answers are indicated.

Answer: 12

Task 25.
Read the task, choose the correct answers.
Which of the following methods can be used to determine the acid content in a solution?
1) Calorimetry 2) Titration
3) Gravimetry 4) Potentiometry
Write down the numbers under which the correct answers are indicated.
Answer: 24

GPC-4.2 Able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained;

Closed-ended tasks to establish compliance

Task 26.
Read the task and match.
Match the substance with the type of its hydrolysis.

Substance		**Type of hydrolysis**	
A	Calcium chloride	1	It doesn't work
B	Aluminum phosphate	2	By cation
IN	Sodium bromide	3	By anion
G	Lithium sulfite	4	By cation and anion

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A2B4B1G3

Task 27.
Read the task and match.
Match a connection to the class it belongs to

Compound		**Class**	
A	FeCl3	1	Complex salt
B	Ca(ClO)Cl	2	Mixed salt
IN	Cr(OH)S	3	Double salt

G	MgLiPO4	4	Medium salt
		5	Acid salt
		6	Basic salt

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A4B2B6G3

Task 28.
Read the task and match.
Match the connection to its geometry

Compound		**Geometry**	
A	Phosphorus fluoride	1	Corner
B	Beryllium hydride	2	Triangular
IN	Fluorine	3	Trigonal pyramid
G	Water	4	Tetrad
		5	Linear

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A2B1B5G1

Task 29.
Read the task and match.
Establish a correspondence between the thermodynamic characteristic and the property of the system

Thermodynamic characteristics		**System property**	
A	Internal energy	1	System operation
B	Enthalpy	2	A measure of the disorder of a system

IN	Entropy	3	A measure of the thermal effect of a system
G	Gibbs energy	4	Kinetic and potential energy of the system
		5	Free energy of the system

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A4B3B2G5

Task 30.
Read the task and match.
Match an ion with a quality reagent for its detection.

Ion		**Reagent**	
A	NO3-	1	Ba
B	PO43-	2	Na
IN	S2-	3	H2SO4
G	CrO42-	4	Ag
		5	Pb

Write the selected numbers in the table under the corresponding letters.

A	B	IN	G

Answer: A3B4B5G1

Closed-ended tasks to establish a sequence

Task 31.
Read the task and establish the sequence.
Arrange the following elements in order of increasing electronegativity
1. Br
2. Fe
3. O
4. Cs

Answer: 4213

Task 32.

Read the task and establish the sequence.

Arrange the following acid residues in order of decreasing acid strength.

1. Cl-
2. ClO4-
3. ClO3-
4. ClO2-

Answer: 1234

GPC-4.3 Possesses skills in working with specialized equipment to implement assigned tasks during research and development of new technologies, including digital ones.

Task 33.

Read the task and establish the sequence.

Arrange the characteristics of electrons in an atom in order to create a descriptive model

1. Spin
2. Energy
3. Orbital
4. Level
5. Magnetic moment

Answer: 43512

Task 34.

Read the task and establish the sequence.

Arrange the stages of heterogeneous catalysis in chronological order.

1. Physical adsorption of reacting molecules on the active centers of the catalyst surface and then their chemisorption;
2. Desorption of products from the catalyst surface;
3. Diffusion of reactants to the surface of a solid;
4. A chemical reaction between reacting molecules;
5. Diffusion of product from the catalyst surface into the general flow.

Answer: 31425

Task 35.

Read the task and establish the sequence.

When the manganese compound was placed in the reaction, a black precipitate was obtained. Then, when the reaction continued in the medium, a flesh-colored precipitate was obtained. By adding a strong oxidizer, this precipitate was converted back to a black color. With prolonged contact with air, the initial compound was returned. Specify the necessary medium for carrying out the reactions.

1. Sour
2. Alkaline
3. Neutral

Answer: 3121

OPEN-TYPE TASKS

Task 36.

Read the task and give a reasoned answer.

How to calculate the ratio of concentrations of a weak acid and its salt (CA:CS) in a buffer solution if pH = 1.74 and pKa = 3.74? Provide the resulting ratio.

Answer: The general formula for calculating the acidity of a buffer solution is pH = pKa + lg[CA:CS]. Given that the difference between pH = pKa is 2, we can assume a concentration ratio of 100:1.

Task 37.

Read the task and give a reasoned answer..

Guess how many times the speed of an arbitrary reaction will increase if the temperature is increased from 10°C to 50°C. What rule allows us to determine the dependence of the reaction speed on temperature? What will allow us to accurately determine the interval of speed increase?

Answer: Van't Hoff's rule determines that with a 10°C increase in temperature, the reaction rate increases by 2-4 times. From this we can assume that under these conditions we can expect an 8-16-fold increase in rate. The Van't Hoff temperature coefficient will help to determine the interval more accurately.

Task 38.

Read the task and give a reasoned answer..

How is covalent bonding achieved? What characteristics can describe it?

Answer: A covalent bond is formed when the electron clouds of atoms overlap in such a way that a common orbital is formed. Such a bond can be described by: length, multiplicity, polarity.

Task 39.

Read the task and give a reasoned answer..

How can the presence of lead nitrate in a solution be confirmed? What rule does such a reaction illustrate?

Answer: Since lead nitrate is a soluble salt, an ion exchange reaction can be carried out to obtain a characteristic yellow precipitate - lead iodide. This reaction illustrates Berthollet's rule.

Task 40.

Read the text and give a detailed, reasoned answer.

What method can be used to determine the arsenic content in a sample? What phenomenon is this method based on?

Answer: Arsenic can be qualitatively determined by the Marsh test. This method is based on the reduction of arsenic in an acidic medium to arsine, which, when passed through a heated tube, decomposes with the formation of a characteristic coating.

3.2. Typical tasks for intermediate certification

3.2.1. Questions for the exam

INORGANIC CHEMISTRY BASIC LAWS

Formed competencies:

UC-1 Able to critically analyze problem situations based on a systematic approach and develop an action strategy:

UC-1ID-1 Know the methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis;

1. Equivalent. Equivalent mass. Equivalent volume (give examples). Law of equivalents.
2. Examples of calculating the equivalent of an element, oxide, base, acid, salt, oxidizing agent, reducing agent.

3. Basic thermodynamic characteristics. 1st, 2nd and 3rd laws of chemical thermodynamics.
4. Gibbs energy. The direction of spontaneous chemical processes.
5. Thermodynamic law of Hess. Thermal effect of the reaction.
6. Rate of chemical reaction. Law of mass action (kinetic).
7. Dependence of the rate of a chemical reaction on temperature. Temperature coefficient. Van't Hoff's rule. Activation theory.
8. The phenomenon of catalysis. Catalysts, principle of operation. Theory of transition state and formation of activated complexes. Biocatalysts.
9. Chemical equilibrium from the point of view of thermodynamics. Equilibrium constant.

UC-1ID-2 Be able to obtain new knowledge based on analysis, synthesis, etc.; collect and summarize data on current scientific issues related to the professional field; search for information and solutions based on actions, experiment, experience, information and communication technologies;

10. Shift in chemical equilibrium. Le Chatelier's principle.
11. Aggregate states. Solutions: Concept, theory. Solutions are saturated, unsaturated, supersaturated.
12. Methods of expressing the concentration of solutions.
13. Osmosis. Van't Hoff's law. The role of osmosis in biological phenomena.
14. Vapor pressure of the solvent above the solution. Royal's law.
15. Boiling and freezing of solutions.
16. Deviation of behavior of electrolyte solutions from non-electrolytes. Isotonic coefficient.
17. Weak electrolytes. Degree of dissociation.
18. Dependence of the degree of dissociation of a weak electrolyte on the concentration of the solution. Ostwald's law of dilution.
19. Equilibrium in solutions of weak electrolytes. Influence of the same and binding ions.
20. Amphoteric hydroxides from the point of view of the theory of electrolytic dissociation.

UC-1ID-3 Be able to study the problem of professional activity using analysis, synthesis and other methods of intellectual activity, including the use of information and communication technologies; identifying problems and using adequate methods to solve them; demonstrating value judgments in solving problematic professional situations.

21. Strong electrolytes. Active concentration. Ionic strength of the solution.
22. Dissociation of water. Ionic product of water. pH value
23. Hydrolysis of salts. Role in a living organism.
24. Modern model of the state of an electron in an atom. Quantum numbers. Pauli's principle.
25. Distribution of electrons in an atom. Hund's principle.
26. Periodic law from the point of view of atomic structure. Reasons for periodicity.
27. s, p, d, f – elements, position in the periodic table. Basic chemical properties.
28. The nature of chemical bonds. Its varieties and properties.

29. Exchange and donor-acceptor mechanisms of covalent bond formation.
30. Covalent bond. Its varieties and properties.
31. Valence of atoms in stationary and excited states. Multiplicity of communication. Sigma bond and pi bond.
32. Hybridization of atomic orbitals. Examples. Spatial configuration of molecules with sp, sp2, sp3 – hybridization (examples).
33. Ionic bond. Non-directionality and unsaturation of ionic bonds. Properties of substances with ionic bonding.
34. Types of intermolecular interactions.
35. Hydrogen bond, its biological role.
36. Complex compounds. Werner's theory. Role in a living organism.
37. Dissociation of complex compounds. Instability constant of complex ions.
38. Chemical bonding in complex compounds (examples).
39. Redox reactions. Types of redox reactions.
40. The most important oxidizing agents and reducing agents. Redox duality.
41. Standard electrode potentials. Direction of redox reactions.

CHEMISTRY OF INORGANIC COMPOUNDS. BIOLOGICAL ROLE, APPLICATION IN VETERINARY.

Formed competencies:

GPC-4 Able to use methods for solving problems in professional activities using modern equipment when developing new technologies and use modern professional methodology to conduct experimental studies and interpret their results:

GPC-4ID-1 Know the technical capabilities of modern specialized equipment, methods for solving problems of professional activity;

1. General characteristics of the halogen subgroup.
2. Methods for producing halogens. Application.
3. Hydrogen compounds of halogens. Properties, application.
4. Chlorine water. Preparation, properties, application.
5. Bleach. Preparation, properties, application.
6. Oxygen-containing acids of halogens. Changes in their strength and oxidative capacity. Salts of oxygen-containing acids. Application.
7. General characteristics of the oxygen subgroup.
8. Water. Physical and chemical properties.
9. Hydrogen sulfide, preparation and properties. Hydrogen sulfide acid. 1st and 2nd dissociation constants. Role in redox processes. Salts of hydrosulfide acid.
10. Sulfuric acid. Role in redox processes. Salts of sulfuric acid. Application.
11. Sulfur compounds in oxidation state +4. Role in redox processes (examples). Application.
12. General characteristics of the nitrogen subgroup.
13. Ammonia. Preparation, chemical properties, application.
14. Nitric acid. Chemical properties. Interaction with metals. Nitrates. Detection.
15. Nitrous acid and its salts. Role in redox processes. Application.
16. Biological role of nitrogen and phosphorus. Application.
17. Arsenic and its compounds. Detection. Effect on a living organism. Application.

18. General characteristics of the elements of the carbon subgroup. Effect on a living organism. Application.
19. Oxygen-containing carbon compounds. Cyanides.

GPC-4ID-2 Be able to apply modern technologies, including digital ones, and research methods in professional activities, interpret the results obtained;

20. Silicon, atomic structure. The most important compounds, their properties, applications.
21. General characteristics of elements of group III of the main subgroup. Application.
22. Bor. Atomic structure, valence. The most important connections. Application.
23. Aluminum and its compounds. Application.
24. General characteristics of the elements of the main subgroup of group II. Application.
25. Water hardness and ways to eliminate it.
26. Alkali metals. Change in ionization potential. Role in redox processes. The most important compounds, biological role, application.
27. Chrome. The structure of the atom. Possible oxidation states. Acid-base properties. Application.
28. Redox properties of chromium compounds with varying degrees of oxidation.
29. Amphotericity of chromium (III) hydroxide. Chromites, their reducing properties.

GPC-4ID-3 Possess skills in working with specialized equipment to implement assigned tasks when conducting research and developing new technologies, including digital ones.

30. Chromic and dichromic acids, their salts, role in redox reactions.
31. Manganese. The structure of the atom. Possible oxidation states. Acid-base properties.
32. Redox properties of manganese compounds depending on the degree of oxidation.
33. Behavior of potassium permanganate in various environments (examples). Application.
34. General characteristics of the iron triad. Role in a living organism.
35. Iron, atomic structure, oxidation states. Changes in the properties of compounds with changes in the oxidation state of iron. Role in a living organism.

4.METHODOLOGICAL MATERIALS DETERMINING PROCEDURES FOR ASSESSING KNOWLEDGE, ABILITIES AND SKILLS AND ACTIVITY EXPERIENCE CHARACTERIZING THE STAGES OF COMPETENCY FORMATION

Criteria for assessing students' knowledge during the colloquium:

- **Mark "excellent"**- the student clearly expresses his point of view on the issues under consideration, giving relevant examples.
- Mark "good" - the student makes some errors in the answer

- **Mark "satisfactory"**- the student discovers gaps in knowledge of the basic educational and regulatory material.
- Mark “unsatisfactory” - the student reveals significant gaps in knowledge of the basic principles of the discipline, inability, with the help of the teacher, to obtain the correct solution to a specific practical problem.

Criteria for assessing students' knowledge during testing:

The test result is assessed on a percentage rating scale. Each student is offered a set of test tasks consisting of 5 questions:

- **Mark "excellent"**– 5 correct answers.
- **Mark "good"**– 4 correct answers.
- **Mark “satisfactory” –**3 correct answers.
- **Mark "unsatisfactory"**– less than 2 correct answers

Criteria for assessing students' knowledge when checking test papers:

- **Mark "excellent"**- the problem is identified and its relevance is justified; an analysis of various points of view on the problem under consideration was made and one’s own position was logically stated; conclusions are formulated, the topic is fully disclosed, the scope is maintained; requirements for external design have been met, basic requirements for the abstract have been met
- Marked “good” - some shortcomings 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.
- Marked “satisfactory” - the topic is only partially covered; there were factual errors in the content of the abstract; there are no conclusions, the topic of the abstract is not disclosed.
- **Mark "unsatisfactory"**- there is a significant misunderstanding of the problem or the abstract is not presented at all.

Knowledge criteria for the exam:

- **Mark "excellent"**– all types of educational work provided for by the curriculum have been completed. The student demonstrates the correspondence of knowledge, abilities, skills with the indicators given in the tables, operates with acquired knowledge, abilities, skills, and applies them in situations of increased complexity. In this case, inaccuracies and difficulties may occur during analytical operations and the transfer of knowledge and skills to new, non-standard situations.
- Mark “good” – all types of educational work provided for by the curriculum have been completed. The student demonstrates the correspondence of knowledge, skills and abilities to the indicators given in the tables, operates with acquired knowledge, skills and abilities, and applies them in standard situations. In this case, minor errors, inaccuracies, and difficulties during analytical operations and the transfer of knowledge and skills to new, non-standard situations may be made.

- Mark “satisfactory” – one or more types of academic work provided for by the curriculum have not been completed. The student demonstrates incomplete compliance of knowledge, abilities, skills with the indicators given in the tables, significant mistakes are made, a partial lack of knowledge, abilities, and skills is manifested in a number of indicators, the student experiences significant difficulties in operating knowledge and skills when transferring them to new situations.
- The mark “unsatisfactory” means that the types of educational work provided for by the curriculum have not been completed. Demonstrates incomplete compliance of knowledge, abilities, and skills with the indicators given in the tables; significant mistakes are made; a lack of knowledge, abilities, and skills is evident in a larger number of indicators; the student experiences significant difficulties in operating knowledge and skills when transferring them to new situations.

5. ACCESSIBILITY AND QUALITY OF EDUCATION FOR PERSONS WITH DISABILITIES

If necessary, disabled people and persons with limited health capabilities are given additional time to prepare an answer for the test.

When carrying out the procedure for assessing the learning outcomes of people with disabilities and people with limited health capabilities, their own technical means may be used.

The procedure for assessing the learning outcomes of people with disabilities and people with limited health capabilities 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 persons with musculoskeletal disorders	– in printed form, device: – in the form of an electronic document.

When carrying out the procedure for assessing the learning outcomes of disabled people and persons with limited health capabilities in the discipline, it ensures the fulfillment of the following additional requirements 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 for submitting assignments 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 assignments (written on paper, typing answers on a computer, orally).

If necessary, for students with disabilities and people with disabilities, the procedure for assessing learning outcomes in the discipline can be carried out in several stages.

The procedure for assessing the learning outcomes of disabled people and persons with limited health capabilities is permitted using distance learning technologies.