

*Federal State Autonomous Educational Institution of Higher Education
“Peoples' Friendship University of Russia”*

Faculty of Physics, Mathematics and Natural Sciences

Recommended by MSSD

ACADEMIC COURSE WORKING PROGRAM

Course name

Chemistry of Biogenic Elements

Recommended for the direction of training (specialty)

31.05.03 Dentistry

Program (profile, specialization)

Dentistry

1. Aims and objectives of discipline:

The purpose of the studying course of chemistry of biogenic elements is to form systemic knowledge about the role of micro- and ultramicroelements in biological processes for using this knowledge as a basis for studying the processes occurring in a living organism.

2. Place of discipline in the structure of OP VO:

The discipline Chemistry belongs to the variable part of block 3 (optional discipline) of the curriculum.

Table 1 shows the preceding and subsequent disciplines aimed at the formation of the competences of the discipline in accordance with the matrix competencies of the OP VO.

Table 1

Preceding and following the discipline aimed at creating competencies

No	Code and title of competence	Preceding disciplines	Following disciplines
Universal competences:			
1	UC-6. Able to determine and implement the priorities of his own activity and ways to improve it on the basis of self-esteem and education throughout his life.	School chemistry course	Biological Chemistry
General Professional Competences			
2	GPC-3. Capable of resisting and combating doping in sports	School chemistry course	Biological Chemistry

3. Requirements for the entrance knowledge, skills and competencies of the student necessary for its study: for the successful study of the discipline, the student must have a basic level of knowledge of secondary (complete) education in chemistry. The chemistry of biogenic elements lays the physicochemical basis for studying the functioning of biological systems at various levels of organization, determines the possibility of an approach to considering life support processes and regulation of homeostasis of living organisms at the molecular level.

Requirements for the results of mastering the discipline: The process of studying the discipline is aimed at the formation of the following competencies:

Table 2

Formed competencies

Competencies	Competency name	Competence achievement indicators
UK-6	Able to determine and implement the priorities of his own activities and	UK-6.1. Evaluates his resources and their limits (personal, situational, time),

	ways to improve it based on self-esteem	uses them optimally for the successful completion of the assigned task.
GPC-3.2	Capable of resisting and combating doping in sports	GPC-3.2. Be able to analyze biochemical, physicochemical and molecular biological mechanisms of the development of pathological processes in the cells of the tissues of the athlete's body, when taking prohibited drugs, defining the principles of the course of biochemical processes when taking illegal drugs

As a result of studying the discipline, the student must:

Know:

1. basic chemical concepts of inorganic chemistry,
2. concepts of coordination chemistry;
3. types of solutions;
4. methods for the qualitative and quantitative determination of trace elements;
5. the role of inorganic ions in organic processes.

Be handy at:

1. use the properties of chemicals in laboratory practice,
2. predict the direction and result of chemical transformations of inorganic compounds,
3. perform calculations related to the determination of the characteristics of substances or solutions.

Manage:

1. skills in handling chemical glassware,
2. skills of safe work in a chemical laboratory
3. the ability to handle caustic, poisonous, volatile compounds,
4. skills in working with burners and electric heating devices, centrifuges, photocolormeters and other devices

4. Volume of discipline and types of study

General credit value of the discipline is **2 credit units**.

Type of study load		Total hours	Semesters	
			I	II
Class hours (total)		34	34	
Include:		-	-	-
<i>Lectures</i>				
<i>Practical training (PT)</i>				
<i>Seminars (S)</i>				
<i>Laboratory research (LR)</i>		34	34	
Independent work (total)		38	38	
Including:				
Essay		18	18	
Test preparation		20	20	
Total labor input		72	72	
hours				
Credit Unit		2	2	

5. Content of the discipline

5.1. The content of the discipline sections

No.	The name of the section discipline	Content section
1	Complex compounds	The concept of coordination compounds. Structure, nomenclature. Electronic features of the structure of complex compounds. Preparation reactions, decomposition, properties of complex compounds. Complex compounds in living systems.
2	Buffer solutions	Buffer solutions. Mechanism of action and pH of buffer solutions of various compositions. Buffer capacity. Buffer solutions in living systems.
3	Colloidal solutions	Types of solutions: true solutions, colloidal solutions. The composition and structure of the micelle. Methods of obtaining and physicochemical characteristics of colloidal solutions.
4	Redox reactions	Oxidation states of elements in simple and complex substances. Oxidation and reduction concepts. Typical oxidizing and reducing agents. Changes in the oxidation states of typical oxidizing and reducing agents. Method of ion-electronic balance of redox reactions. Redox reactions in living systems.
5	Introduction to analytical chemistry	Qualitative analysis concept. Division of cations and anions into analytical groups. Group and specific reactions. Quantitative chemical analysis. Calculation methods in quantitative analysis. Titrimetric methods of analysis: complexometry, redoximetry, their application for the quantitative determination of the content of biogenic elements calcium, iron, copper.

5.2. Sections of disciplines and types of classes

No	Section Name, disciplines and topics	lectures	<i>Practical training and Laboratory research</i>			Total hour.
			PC	LR	Independent work	
1.	Complex compounds			4	4	8
2.	Buffer solutions			2	6	8
3.	Colloidal solutions			2	4	6
4.	Redox reactions			4	6	10
5.	Introduction to analytical chemistry			22	18	40
Total:				34	38	72

6. Laboratory training (if available)

In a laboratory class, it is examined in detail, repeated, and a generalization of the main theoretical issues is carried out. Homework is checked. Tasks are solved that correspond to the content of the practical lesson. Laboratory work is carried out with a theoretical analysis of each experiment.

No	No. of section of discipline	Name of laboratory training	Labor capacity (hour.)
1.	1	Ways of isolation of complex compounds	1
2.	1	Reactions of complex compounds	1
3.	2	Buffer solutions	2
4.	3	Colloidal solutions	2
5.	1, 5	Standardization of the solution of EDTA	2
6.	1, 5	Determination of the content of a biogenic element of calcium	2
7.	1-3,5	Test 1	2
8.	4	Redox reactions	2
9	4, 5	Standardization of a working solution of potassium permanganate	2
10	4, 5	Determination of a content of biogenic element of iron	2
11	4, 5	Standardization of working solutions in iodometry	2
12	4, 5	Determination of a content of biogenic element of copper	2
13	4	Corrosion of metals and alloys	2
14	5	Qualitative determination of I – III analytical groups cations	2
15	5	Qualitative determination of IV – VI analytical groups cations	2
16	5	Qualitative reactions of anions	2
17	5	Analytical test	2
18	4, 5	Test 2	2

7. Practical training (no)

8. Material and technical support of the discipline:

Educational laboratories: 620, 621, 622, 705. Laboratory work is carried out in specially equipped educational laboratories. General chemistry laboratories are equipped with standard equipment: a set of special chemical glassware, a set of necessary chemical reagents, an analytical balance, a distiller, and a centrifuge. All equipment in laboratories is quite modern. Students have access to electronic versions of the lecture course, homework, tests.

9. Information support of the discipline:

a) Microsoft Word, Microsoft Office software (Excel, Power Point), ACD Chemoffice

b) resources information and telecommunication network "Internet"

1. EBS PFUR and third-party EBS, to which university students have access on the basis of concluded contracts:

Electronic library system RUDN - EBS RUDN

<http://lib.rudn.ru/MegaPro/Web>

EBS "University Library Online" <http://www.biblioclub.ru>

EBS Yurayt <http://www.biblio-online.ru>
EBS "Student Consultant" www.studentlibrary.ru
EBS "Lan" <http://e.lanbook.com/>

2. Databases and search engines:

- electronic fund of legal and regulatory and technical documentation

<http://docs.cntd.ru/>

Yandex search engine <https://www.yandex.ru/>

search system Google <https://www.google.ru/>

- http://web-local.rudn.ru/web-local/prep/prep_1844/,
- <http://www.chemistry.ssu.samara.ru/>
- <http://www.chem.msu.su/rus/library/welcome.html>
- www.xumuk.ru
- <http://www.ch.ic.ac.uk/local/organic/>
- <http://www.chemport.ru> Chemical encyclopedia
- <http://ru.wikipedia.org>

10. Educational and methodical support of the discipline:

a) Main literature

- Slesarev V.I. Chemistry. The basics of living chemistry. St. Petersburg: Himizdat, 2005.
- Glinka N.L. Tasks and exercises in general chemistry M.: Higher. shk., 1988.
- Kovalchukova O.V, Avramenko O.V Laboratory work in general and bioorganic chemistry. Part 1. General chemistry. M.: publishing house of RUDN, 2007
- Kovalchukova O.V Lectures on general and bioorganic chemistry. Part 1. General chemistry. M.: Publishing house RUDN, 2011.
- Kovalchukova O.V, Avramenko O.V Lectures on general and bioorganic chemistry. Part 2. Bioorganic chemistry. M.: Publishing house of RUDN, 2010.
- Kolyadina N.M., Kovalchukova O.V., Shebaldina L.S. Laboratory work in general and bioorganic chemistry. Part 2. Bioorganic chemistry. M.: publishing house of RUDN, 2008.

b) additional literature

- Khomchenko G.P., Tsitovich I.K. Inorganic chemistry. -M.: Higher School, 1986, and others.
- Tyukavkina N.A., Baukov Yu.I. Bioorganic chemistry. "Drofa", Moscow, 2005, 2011.
- Grandberg I.I., Organic Chemistry. "Bustard", Moscow, 2002.
- c) List of educational electronic materials:
- Lectures on general chemistry for the specialty "Dentistry".
- Lectures on organic chemistry for the specialty "Dentistry".

11. Guidelines for students on the development of the discipline (module)

In laboratory classes and lectures, the relevant topics are analyzed using multimedia technology (computer, projector). For each lecture there are presentations prepared in Microsoft PowerPoint, containing from 10 to 60 slides. The main purpose of laboratory studies is to perform experimental experiments in order to consolidate the theoretical material.

Students are required to attend laboratory classes, weekly consultations, obligatory participation in certification tests, perform assignments within the framework of classroom and independent work using recommended textbooks and teaching aids, electronic educational resources, databases, information and reference and electronic search systems.

During certification, the quality of students' work in the classroom, the completeness and quality of laboratory work and assignments for independent work, control and test work is assessed. Preparation and subsequent implementation of laboratory work is a prerequisite for

admitting a student to test work, including the subject of laboratory work. The postponement of laboratory work and the writing of test papers is considered valid only in the event of a student's illness, which is confirmed by the presence of a medical certificate. Unfinished laboratory work must be completed within ten days after the closing date of the medical certificate.

Educational materials in electronic form on all topics studied, as well as virtual laboratories are posted on the RUDN University Training Portal, in TUIS, on the local resources of the RUDN University electronic library system. Presentations on the topics of classes can be recorded on CDs or flash cards for independent work of students on a home computer.

For the final certification, a point-rating system for assessing knowledge is used. Students are required to submit all assignments within the timeframe established by the curriculum. Works submitted with a delay are not evaluated, tests are not rewritten.

12. Fund of estimated means for the interim assessment of students in the discipline (module)

Materials for assessing the level of mastering the educational material of the discipline "Chemistry of biogenic elements" (evaluation materials), including a list of competencies indicating the stages of their formation, a description of indicators and criteria for evaluating competencies at various stages of their formation, a description of the assessment scales, standard control tasks or other materials, necessary for assessing knowledge, abilities, skills and (or) experience of activities that characterize the stages of the formation of competencies in the process of mastering the educational program, methodological materials that determine the procedures for assessing knowledge, abilities, skills and (or) experience of activity that characterize the stages of formation of competencies, are developed in full and are available for students on the discipline page at TUIS RUDN University.

The program is compiled in accordance with the requirements of the FSES HE.

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