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**Federal State Autonomous Educational Institution of Higher Education  
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA  
RUDN University  
Institute of Medicine**

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educational division (faculty/institute/academy) as higher education programme developer

## **COURSE SYLLABUS**

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**Chemistry of Biogenic elements**

course title

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**Recommended by the Didactic Council for the Education Field of:**

**31.05.03 Dentistry**

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field of studies / speciality code and title

**The course instruction is implemented within the professional education programme of higher education:**

**Dentistry**

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higher education programme profile/specialisation title

## 1. COURSE GOAL(s)

The goal of the course “Chemistry of Biogenic Elements” is to form systematic knowledge about the role of inorganic cations in biological processes for using this knowledge as a basis for studying the processes occurring in a living organism and the basic materials used in dental practice.

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the course (module) “Chemistry of Biogenic Elements” is aimed at the development of the following competences /competences in part: GC-1, GPC-8, GPC-13.

*Table 2.1. List of competences that students acquire through the course study*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Competence formation indicators (within this course)</b>
GC-1	Able to carry out a critical analysis of problem situations based on a systematic approach, to develop an action strategy.	GC -1.1. Uses the acquired knowledge system to carry out a critical analysis of the problem situation.
GPC-8	Able to use the basic physical-chemical, mathematical and natural science concepts and methods in solving professional problems.	GPC-8.1. Possesses basic physical-chemical, mathematical and natural science concepts and methods for solving professional problems.
GPC-13	Able to solve standard problems of professional activity using information, bibliographic resources, biomedical terminology, information and communication technologies, taking into account the basic requirements of information security.	GPC -13.1. Uses information technologies in professional activities and complies with information security rules. information and communication means and technologies in professional activity.

## 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the core/variable/elective\* component of (B1) block of the higher educational programme curriculum.

\* - Underline whatever applicable.

Within the higher education programme students also master other (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

*Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Previous courses/modules*</b>	<b>Subsequent courses/modules*</b>
GC-1	Able to carry out a critical analysis of problem situations based on a systematic approach, to develop an action strategy.	-	Chemistry, Biological chemistry, Pharmacology
GPC-8	Able to use the basic physical-chemical, mathematical and natural science concepts	-	Chemistry, Materials Science.

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
	and methods in solving professional problems.		
GPC-13	Able to solve standard problems of professional activity using information, bibliographic resources, biomedical terminology, information and communication technologies, taking into account the basic requirements of information security.	-	Chemistry, Materials Science, Pharmacology.

#### 4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course is 2 credits (72 academic hours).

Type of academic activities	Total academic hours	Semesters/training modules			
		1	2	3	4
<i>Contact academic hours</i>	<b>34</b>	<b>34</b>			
including:					
Lectures (L)					
Lab works (LW)	34	34			
Seminars (workshops/tutorials) (S)					
<i>Self-study (ies), academic hours</i>	38	38			
<i>Evaluation and assessment (exam or pass/fail grading), academic hours</i>					
<b>Course workload</b>	academic hours	<b>72</b>	<b>72</b>		
	credits	<b>2</b>	<b>2</b>		

\* To be filled in regarding the higher education programme correspondence training mode.

#### 5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Forms of finding metal cations in living systems. Coordination compounds.	General concepts of the chemistry of biogenic elements. The role of inorganic elements (metal cations) in life processes. Complex compounds. Composition, electronic structure, nomenclature. Chemical reactions involving complex compounds. Examples of vital complex compounds: hemoglobin, chlorophyll, metalloenzymes.	LW

Ways to maintain pH in living systems. Buffer solutions.	The concept of pH. Changes in pH in neutral, acidic and alkaline solutions. buffer solutions. Mechanism of action and pH of buffer solutions of various compositions. buffer capacity. Buffer solutions in living systems.	LW
Forms of transportation and storage of metal cations in living systems. Colloidal solutions	Soluble and insoluble forms, including biometals. Stabilization of soluble forms due to micellization. The concept of colloidal solutions. Composition and structure of micelles. Methods for obtaining and physical-chemical characteristics of colloidal solutions.	LW
Redox reactions	The concepts of oxidation and reduction. Typical oxidizing and reducing agents. Changing the oxidation states of typical oxidizing and reducing agents. Method of ion-electronic balance of redox reactions. Redox reactions in living systems.	LW
The methods of qualitative and quantitative analysis in bioinorganic chemistry	The concept of qualitative analysis. Group and specific reactions of cations and anions. Quantitative titrimetric analysis and its application in bioinorganic chemistry	LW

\* - to be filled in only for **full**-time training: LC - lectures; LW - lab work; S - seminars.

## 6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
Lab work	Classroom for lab works, equipped with a set of specialized furniture	A set of specialized furniture, reagent kits, stands, chemical glassware (test tubes, cups, flasks, pipettes, burettes), D.I. Mendeleev's table, activity series of metals, solubility table, marker board, markers, sponge, fume hood, centrifuge, photocolorimeters, potentiometers, analytical balances, multimedia systems.
Self-studies	Classroom for seminar-type classes, self-studies, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and multimedia equipment	A set of devices includes portable multimedia projector, laptop, projection screen, stable wireless

## 7. RESOURCES RECOMMENDED FOR COURSE STUDY

### *Main readings:*

- Harper`s Illustrated Biochemistry: textbook / Rodwell V. W., Bender D. A., Botham K. M., Kennelly P. J., Weil P. A. - United States: McGraw Hill Education, 2015 - 817 c. - 30-th Edition.
- Sharma R.K. Textbook of Coordination Chemistry.-New Delhi: Discovery Publishing House, 2007 – 285p.
- Medical chemistry: a textbook for universities / V.O. Kalibabchuk, IS Chekman, VI Galynska and others; for ed. prof. V.O. Kalibabchuk - K. VSV "Medicine", 2013 - 328p.
- Kovalchukova O.V., Avramenko O.V., Kolyadina N.M. Chemistry of biogenic elements. Laboratory work. M.: Publishing house of RUDN, 2017.
- 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.

### *b) Additional readings:*

- Geoffrey A. Lawrance. Introduction to Coordination. A Wiley Series of Advanced Textbooks. NSW, Australia, 2010 -304 p.
- David R. Klein. Organic Chemistry. 1st Edition. Wiley, 2011 – 1392 p.
- Kovalchukova O.V., Avramenko O.V., Vu Thi Nkog An The theoretical foundations of the course "Chemistry". M.: Publishing house of RUDN,2018.

### *c) List of educational and electronic materials:*

- Lectures on general chemistry for the specialty "Dentistry".
- Lectures on organic chemistry for the specialty "Dentistry".

### *Internet sources:*

#### 1. Electronic libraries with access for RUDN students:

- Electronic libraries of RUDN
- ELS «University Library Online» <http://www.biblioclub.ru>
- ELS Юрайт <http://www.biblio-online.ru>
- ELS «Student Advisor» [www.studentlibrary.ru](http://www.studentlibrary.ru)
- ЭБС «Лань» <http://e.lanbook.com/>

#### 2. Databases and search engines:

- electronic fund of legal and normative-technical documentation <http://docs.cntd.ru/>
- search system Яндекс <https://www.yandex.ru/>
- search system Google <https://www.google.ru/>
- [http://web-local.rudn.ru/web-local/prep/prep\\_1844/](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.xumuk.ru)
- <http://www.ch.ic.ac.uk/local/organic/>
- <http://www.chemport.ru>
- <http://ru.wikipedia.org>

*Training toolkit for self- studies to master the course* \*:

1. The set of lectures on the course “Chemistry of Biogenic elements”
2. The laboratory workshop (if any).on the course “Chemistry of Biogenic elements”
3. The guidelines for writing a course paper / project (if any) on the course “Chemistry of Biogenic elements”.
4. ....

\* The training toolkit for self- studies to master the course is placed on the course page in the university telecommunication training and information system under the set procedure.

## **8. ASSESSMENT TOOLKIT AND GRADING SYSTEM\* FOR EVALUATION OF STUDENTS’ COMPETENCES LEVEL UPON COURSE COMPLETION**

The assessment toolkit and the grading system\* to evaluate the competences formation level (GC-1, GPC-8, GPC-13) upon the course study completion are specified in the Appendix to the course syllabus.

\* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

### **DEVELOPERS:**

Associate Professor of the  
General Chemistry Department  
Assistant of the General  
Chemistry Department

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position, department

Associate Professor of the  
General Chemistry Department  
Assistant of the General  
Chemistry Department

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position, department

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signature

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signature

Polyanskaya N. A.

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name and surname

Stepnova A.F.

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name and surname

### **HEAD OF EDUCATIONAL DEPARTMENT:**

The Department of General  
Chemistry

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name of department

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signature

Davudov V.V.

---

name and surname

### **HEAD OF HIGHER EDUCATION PROGRAMME:**

First Deputy Director of Medical  
Institute

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position, department

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signature

Razumova S.N.

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name and surname