

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION

**Federal State Autonomous Educational Institution of Higher Education  
«National Research Lobachevsky State University of Nizhny Novgorod»**

Институт клинической медицины

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УТВЕРЖДЕНО

решением Ученого совета ННГУ

протокол № 10 от 02.12.2024 г.

**Working programme of the discipline**

General chemistry

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Higher education level

Specialist degree

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Area of study / speciality

31.05.03 - Dentistry

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Focus /specialization of the study programme

Dentistry

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Mode of study

full-time

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Nizhny Novgorod

Year of commencement of studies 2025

## 1. Место дисциплины в структуре ОПОП

Дисциплина Б1.О.16 Общая химия относится к обязательной части образовательной программы.

## 2. Планируемые результаты обучения по дисциплине, соотнесенные с планируемыми результатами освоения образовательной программы (компетенциями и индикаторами достижения компетенций)

Формируемые компетенции (код, содержание компетенции)	Планируемые результаты обучения по дисциплине (модулю), в соответствии с индикатором достижения компетенции		Наименование оценочного средства	
	Индикатор достижения компетенции (код, содержание индикатора)	Результаты обучения по дисциплине	Для текущего контроля успеваемости	Для промежуточной аттестации
ОПК-8: Способен использовать основные физико-химические, математические и естественнонаучные понятия и методы при решении профессиональных задач	ОПК-8.1: Знать основные физико-химические, математические и естественнонаучные понятия и методы ОПК-8.2: Уметь использовать основные физико-химические, математические и естественнонаучные понятия и методы при решении профессиональных задач ОПК-8.3: Владеть опытом использования основных физико-химических, математических и естественнонаучных понятий и методов при решении профессиональных задач	ОПК-8.1: Знает основные физико-химические, математические и естественнонаучные понятия и методы  ОПК-8.2: Умеет использовать основные физико-химические, математические и естественнонаучные понятия и методы при решении профессиональных задач  ОПК-8.3: Владеет опытом использования основных физико-химических, математических и естественнонаучных понятий и методов при решении профессиональных задач	Опрос	Экзамен: Контрольные вопросы

## 3. Структура и содержание дисциплины

### 3.1 Трудоемкость дисциплины

	очная
Общая трудоемкость, з.е.	3
Часов по учебному плану	108
в том числе	
аудиторные занятия (контактная работа):	
- занятия лекционного типа	32

- занятия семинарского типа (практические занятия / лабораторные работы)	16
- КСР	2
самостоятельная работа	22
Промежуточная аттестация	36 Экзамен

### 3.2. Содержание дисциплины

(структурированное по темам (разделам) с указанием отведенного на них количества академических часов и виды учебных занятий)

Наименование разделов и тем дисциплины	Всего (часы)	в том числе			
		Контактная работа (работа во взаимодействии с преподавателем), часы из них			Самостоятельная работа обучающегося, часы
		Занятия лекционного типа	Занятия семинарского типа (практические занятия/лабораторные работы), часы	Всего	
	0 Ф 0	0 Ф 0	0 Ф 0	0 Ф 0	0 Ф 0
Atomic and molecular theory	9	4	2	6	3
The structure of the atom	9	4	2	6	3
Periodic law and periodic system of elements by D.I.Mendeleev	9	4	2	6	3
Chemical bonding. The structure of molecules	9	4	2	6	3
Chemistry of s-elements	9	4	2	6	3
Chemistry of p-elements	11	6	2	8	3
General characteristics of d-elements. Complex connections	14	6	4	10	4
Аттестация	36				
КСР	2				2
Итого	108	32	16	50	22

### Contents of sections and topics of the discipline

Topic 1. Introduction. Atomic and molecular theory.

The subject of chemistry. The importance of chemistry. The role of chemistry in biology. The concept of a substance. Simple and complex substances. Physical and chemical phenomena. Atomic and molecular theory: an introduction to history. Works by Lomonosov, Lavoisier, Dalton. The concept of the atom. The atomic unit of mass. The relative atomic mass. The concept of a chemical element. Isotopes. The concept of a molecule. Relative molecular weight. Molecular and structural formulas. Molecular and crystalline allotropy. Mole. Molar mass. Stoichiometric laws of chemistry: the law of conservation of mass, the law of constancy of composition, the law of multiple ratios, the law of equivalents. The concept of equivalent, equivalent mass. Calculation of the equivalent mass of a simple and complex substance. The equivalent volume. Gas laws: Dalton's law of partial pressures, the law of simple volume relations, Avogadro's law and its consequences. The molar volume of the gas. The relative density of one gas over another gas. The Mendeleev-Clapeyron, Van der Waals equations.

Determination of the formula of the substance by percentage composition. The Dulong and Petit rule.

#### Topic 2. The structure of the atom.

An introduction to the history of the issue. The development of ideas about the structure of the atom. Models of the structure of the atom (Thomson, Rutherford). Electromagnetic waves. Characteristics of electromagnetic waves: length, amplitude, frequency, wave number. The quantized nature of energy changes. Planck's equation. Atomic spectra. The spectrum of atomic hydrogen. The Rydberg equation. The planetary model of the Boron atom. Wave-particle dualism. The de Broglie equation. Heisenberg's uncertainty principle. A quantum mechanical representation of the structure of the atom. The wave function (concept). Quantum numbers. Atomic orbitals. Boundary surfaces of s-, p-, and d-orbitals. Nodal surfaces. Multielectronic atoms. Factors affecting the energy of multielectronic atoms. Principles and sequence of filling electronic shells: Pauli principle, minimum energy (Klechkovsky rule), Hund rule. Electronic passports of atoms. Filling of shells for elements of the I, II, III, IV periods.

#### Topic 3. Periodic law and periodic system of elements by D.I. Mendeleev.

Attempts to systematize the elements. The discovery of the periodic law by D.I. Mendeleev. The structure of the periodic table. The reason for periodic changes in the properties of the elements. Features of the electronic structure of the atoms of the elements of the main and secondary subgroups. s-, p-, d-, f-Elements. Properties of free atoms: ionization energy and potential, electron affinity, atomic radius and frequency of their changes.

#### Topic 4. Chemical bonding. The structure of molecules.

The background of the issue. The reasons for the formation of a chemical bond. The main characteristics of a chemical bond are energy, length, valence angle, and bond polarity. The effective charge of atoms. The dipole moment of the connection. The dipole moment of a polyatomic molecule. The concept of electronegativity of atoms. The Pauling scale. The change in the values of electronegativity by periods and groups. The degree of oxidation of the elements. Calculation of the degree of oxidation. Valence of chemical elements. Various interpretations of the concept of valence in modern chemistry. The method of valence bonds. The main provisions of the valence bond method. Mechanisms of formation of common covalent bond electron pairs. Donor-acceptor relationship. Valence capabilities of the elements. Single and multiple connections. Formation of  $\pi$ - and  $\sigma$ -connections. Hybridization of AO: sp, sp<sup>2</sup>, sp<sup>3</sup>, sp<sup>3</sup>d, sp<sup>3</sup>d<sup>2</sup>. The geometry of the molecules BeF<sub>2</sub>, BF<sub>3</sub>, CH<sub>4</sub>, NH<sub>3</sub>, H<sub>2</sub>O, PCl<sub>5</sub>, SCl<sub>6</sub>. Multicenter connections. The structure of HNO<sub>3</sub>, O<sub>3</sub>, SO<sub>2</sub>, SO<sub>3</sub> molecules. Advantages and disadvantages of the valence bond method. The method of molecular orbitals. The main provisions of the MO method. Binding and loosening MO.  $\pi$ - and  $\sigma$ -MO. Energy diagrams of MO. Homoatomic molecules of elements of the I and II periods. Diamagnetic and paramagnetic molecules. Heteroatomic molecules of CO and NO. Comparison of VS and MO methods. The ionic bond. The mechanism of formation of an ionic bond. The dependence of the interionic interaction on the distance between ions. The Born equation. Features of the ionic bond. Metal connection. Intermolecular interaction. The Van der Waals forces. The energy of intermolecular interaction in comparison with the energy of chemical interaction. Orientation, induction and dispersion interaction. Factors determining the energy of intermolecular interaction. The hydrogen bond. The nature of the hydrogen bond. Inter- and intramolecular hydrogen bonding. The energy of the hydrogen bond. The dependence of the physical properties of substances with a molecular structure on the nature of intermolecular interaction (boiling point, melting point, heat of phase transitions).

#### Topic 5. Chemistry of s-elements.

Features of the structure of atoms. The ability to form chemical bonds. The nature of property changes in groups. Hydrogen. The position of the element in the periodic table. Isotopes of hydrogen. Physical and chemical properties. Interaction with metals and non-metals. Hydrides. Basic and acidic hydrides. The degree of oxidation of the atom. Being in nature. Water. The role of water in biological processes. Alkaline and alkaline earth metals. Physical and chemical properties. Relation to water, acids, and nonmetals. Changes in chemical activity in groups. Oxides and peroxides of metals. Salt. Sodium and potassium chlorides. Carbonates. Calcium oxide and hydroxide. Water hardness and ways to eliminate it. Biological functions of potassium and sodium, calcium and magnesium in a living organism.

#### Topic 6. Chemistry of p-elements.

General overview. Features of the electronic structure of atoms. The most important chalcogens are oxygen and

sulfur. Oxygen. The structure of the atom and its main characteristics. Being in nature, physical and chemical properties, obtaining. The biological role of oxygen. Physical properties of oxygen. Chemical properties. The ability to oxidize. Formation of oxides. General characteristics of oxides. Basic, amphoteric, acidic oxides. A natural change in properties in periods and groups. Formation of superoxide ( $\text{O}_2^-$ ) and peroxide ( $\text{O}_2^{2-}$ ) ions. Superoxides and peroxides of metals. Hydrogen peroxide. Properties and behavior in aqueous solutions. Oxidizing and reducing properties. Application in engineering, everyday life, medicine. The role of hydrogen peroxide in living systems. Ozone. The structure of the molecule. Physical properties. Ozone formation in various processes. The protective role of ozone in nature. Oxidative activity of ozone. Ozonides.

Sulfur. The structure of the atom, the main characteristics. Distribution in nature. Allotropic modifications. Physical properties. Sulfur compounds with an oxidation state of -2. Hydrogen sulfide. Features. Sulfides and hydrosulfides. Reducing properties of sulfide ion. Sulfur compounds with an oxidation state of +4. The problem of  $\text{SO}_2$  utilization from the atmosphere. Sulfurous acid. Sulfites and hydrosulfites. Sulfur compounds with an oxidation state of +6. The structure of the  $\text{SO}_3$  molecule. Physical and chemical properties. Sulfuric acid. Sulfates and hydrosulfates.

Nitrogen. The structure of the atom, the main characteristics. Possible degrees of oxidation. Molecular nitrogen. Receiving. Physical and chemical properties. Nitrides of the elements. Ammonia. Interaction with water and acids. Nitrogen oxides. Nitric acid and its salts. The interaction of nitric acid of various concentrations with metals. Nitric acid salts and their application. Ammonium, potassium and sodium nitrates. The nitrogen cycle in nature. The biochemical role of nitrogen.

Phosphorus. The structure of the atom, the main characteristics. Allotropic modifications of phosphorus. Phosphides. Phosphine. Phosphonium salts. Phosphorus halides. Phosphorous acid. Phosphates. The use of phosphoric acid salts. The biological role of phosphorus.

Halogens. General overview. The electronic configuration of atoms. Being in nature. Chlorine. Physical and chemical properties. Receiving. Hydrochloric acid and its salts. The most important chlorine compounds. The biochemical role of halogens.

Carbon. Being in nature. The allotropy of carbon. Carbon oxides. Carbonic acid and its salts. The role of carbon in organic chemistry.

Topic 7. General characteristics of d-elements. Complex connections.

A general overview of the d-elements. Features of the structure of the electronic shell. Werner's coordination theory. The main and secondary valences. The nature of the forces of complex formation. Ligand, complexing agent, coordination number. Cationic, anionic, and electroneutral complex compounds. The nomenclature of complex compounds. Factors affecting the properties of complex compounds. Ligands: mono-, bi-, polydentant. Chelated complex compounds. Stability of complex compounds. The role of complex compounds in biological processes. Hemoglobin. Chlorophyll. Biometals and bioligands.

#### **4. Учебно-методическое обеспечение самостоятельной работы обучающихся**

Самостоятельная работа обучающихся включает в себя подготовку к контрольным вопросам и заданиям для текущего контроля и промежуточной аттестации по итогам освоения дисциплины приведенным в п. 5.

Зайцев С.Д. Растворы: Практикум. Нижний Новгород: Нижегородский госуниверситет, 2012. 27 с.;

Копылова Н.А., Зайцев С.Д. Методы очистки веществ: Фильтрование и перекристаллизация. Учебно-методическое пособие. Нижний Новгород: Нижегородский госуниверситет, 2014. 14 с.;

Копылова Н.А., Зайцев С.Д. МЕТОДЫ ОЧИСТКИ ВЕЩЕСТВ: ПЕРЕГОНКА. Учебно-методическое пособие. Нижний Новгород: Нижегородский госуниверситет, 2014. 11 с.

## 5. Assessment tools for ongoing monitoring of learning progress and interim certification in the discipline (module)

### 5.1 Model assignments required for assessment of learning outcomes during the ongoing monitoring of learning progress with the criteria for their assessment:

#### 5.1.1 Model assignments (assessment tool - Interview) to assess the development of the competency OIK-8:

1. Illustrate the law of multiple ratios using the example of four selected hydrocarbons
2. Write the sets of all four quantum numbers for each electron that are in the 4s atomic orbital.
3. What are the following values for nitrogen: a) the mass of one molecule; b) the relative molecular weight; c) the molar mass? How many molecules are contained in one, fourteen and twenty-eight grams of this substance?
4. At what energy level and at what AO can an electron be located for which  $n = 3$  and  $l = 1$ ? What is the boundary surface of this AO?
5. Why are the absolute masses of atoms and molecules very rarely used in chemical calculations? What is used as a unit of measurement for relative atomic and molecular masses? Show that the relative molecular weight of nitrogen is equal to the molar mass.
6. How many nodal surfaces do 3s, 2px and 3dxz atomic orbitals have? What is their shape?
7. Determine the total number of protons, electrons and neutrons in a sulfuric acid molecule containing the isotope  $^{34}\text{S}$ .
8. For the manganese atom: write the complete electronic configuration; write the sets of all four quantum numbers for each valence electron.
9. On what basis are phosphorus and vanadium placed in the same group of the periodic table? Why are they placed in different subgroups?
10. What energy must be expended to excite an electron in a hydrogen atom in the ground state (at the first energy level) to the second and fifth energy levels?

#### Assessment criteria (assessment tool — Interview)

Grade	Assessment criteria
pass	The level of knowledge in the volume corresponding to the training program. Several gross mistakes were made.
fail	The level of knowledge is below the minimum requirements. There were gross mistakes.

### 5.2. Description of scales for assessing learning outcomes in the discipline during interim certification

#### Шкала оценивания сформированности компетенций

Уровень сформированности компетенций (индикатора достижения компетенций)	плохо	неудовлетворительно	удовлетворительно	хорошо	очень хорошо	отлично	превосходно
	не зачтено		зачтено				
<u>Знания</u>	Отсутствие знаний теоретического материала. Невозможность оценить полноту знаний вследствие отказа обучающегося от ответа	Уровень знаний ниже минимальных требований. Имели место грубые ошибки	Минимально допустимый уровень знаний. Допущено много негрубых ошибок	Уровень знаний в объеме, соответствующем программе подготовки. Допущено несколько негрубых ошибок	Уровень знаний в объеме, соответствующем программе подготовки. Допущено несколько несущественных ошибок	Уровень знаний в объеме, соответствующем программе подготовки. Ошибок нет.	Уровень знаний в объеме, превышающем программу подготовки.
<u>Умения</u>	Отсутствие минимальных умений. Невозможность оценить наличие умений вследствие отказа обучающегося от ответа	При решении стандартных задач не продемонстрированы основные умения. Имели место грубые ошибки	Продemonстрированы основные умения. Решены типовые задачи с негрубыми ошибками. Выполнены все задания, но не в полном объеме	Продemonстрированы все основные умения. Решены все основные задачи с негрубыми ошибками. Выполнены все задания в полном объеме, но некоторые с недочетами	Продemonстрированы все основные умения. Решены все основные задачи. Выполнены все задания в полном объеме, но некоторые с недочетами.	Продemonстрированы все основные умения. Решены все основные задачи с отдельными несущественными недочетами, выполнены все задания в полном объеме	Продemonстрированы все основные умения. Решены все основные задачи. Выполнены все задания, в полном объеме без недочетов
<u>Навыки</u>	Отсутствие базовых навыков. Невозможность оценить наличие навыков вследствие отказа обучающегося от ответа	При решении стандартных задач не продемонстрированы базовые навыки. Имели место грубые ошибки	Имеется минимальный набор навыков для решения стандартных задач с некоторыми недочетами	Продemonстрированы базовые навыки при решении стандартных задач с некоторыми недочетами	Продemonстрированы базовые навыки при решении стандартных задач без ошибок и недочетов	Продemonстрированы навыки при решении нестандартных задач без ошибок и недочетов	Продemonстрирован творческий подход к решению нестандартных задач

### Scale of assessment for interim certification

Grade		Assessment criteria
pass	outstanding	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "outstanding", the knowledge and skills for the relevant competencies have been demonstrated at a level higher than the one set out in the programme.

	<b>excellent</b>	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "excellent",
	<b>very good</b>	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "very good",
	<b>good</b>	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "good",
	<b>satisfactory</b>	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "satisfactory", with at least one competency developed at the "satisfactory" level.
<b>fail</b>	<b>unsatisfactory</b>	At least one competency has been developed at the "unsatisfactory" level.
	<b>poor</b>	At least one competency has been developed at the "poor" level.

### 5.3 Model control assignments or other materials required to assess learning outcomes during the interim certification with the criteria for their assessment:

#### 5.3.1 Model assignments (assessment tool - Control questions) to assess the development of the competency ОПК-8

1. Basic chemical concepts: atomic unit of mass, relative atomic mass, relative molecular weight. What are the following values for nitrogen: a) the mass of a single molecule; b) the relative molecular weight; c) the molar mass? How many molecules are contained in fourteen grams of this substance?
2. Explain the mechanism of formation of  $\text{BeCl}_2$  and  $\text{BCl}_3$  molecules. Specify the type of hybridization of the atomic orbitals of the central atom, estimate the valence angle, dipole moment, and polarity of the molecules.
3. From a solution of the  $\text{CoCl}_3 \cdot 4\text{NH}_3$  complex salt, silver nitrate precipitates only 1/3 of the chlorine contained in it. Write the coordination formula of the salt, name it and characterize the behavior of this complex compound in solution.
4. A 25% solution of sodium sulfate has a density of 1.25 g/ml. Determine the mole fraction, titer, molar, normal and molar concentrations of this solution.
5. Formulate the principles and sequence of filling atomic orbitals with electrons. Write down the complete electronic configuration of the element number 15, as well as the sets of all four quantum numbers for each valence electron of this element.
6. Valence. Quantitative estimates of valence. What is the valence of nitrogen in nitric acid? Sodium in sodium chloride?
7. Formulate the law of multiple ratios and illustrate it with the example of sodium oxide, peroxide and superoxide.
8. Define the main and secondary subgroups. On what basis are phosphorus and vanadium placed in the same group of the periodic table? Why are they placed in different subgroups?



9. Depict the electronic configuration of  $\text{Li}^+$  and  $\text{H}^-$  ions. Are the sizes of the ions the same? Justify your answer.
10. How do the bond length, bond order, and dissociation energy of the following molecular particles in a row change:  $\text{C}_2^+ - \text{C}_2 - \text{C}_2^-$ . Justify the answer. Specify paramagnetic particles.
11. Ways of expressing concentration.
12. Electrolytic dissociation of compounds. The pH of aqueous solutions. Hydrolysis of salts.
13. General characteristics of s-elements. Preparation, properties and application of potassium and sodium.
14. General characteristics of p-elements. Production, properties and application of nitrogen.
15. Nitric acid, its salts – preparation, properties, application.
16. Phosphorus, phosphoric acid, its salts – preparation, properties, application.
17. Halogens – fluorine, chlorine, bromine, iodine – being in nature, obtaining, properties, application.
18. Characteristics of d-elements. Iron, cobalt, nickel – production, properties, application.
19. General characteristics of metals. The main methods of obtaining metals.
20. Corrosion of metals.
21. Being in nature, obtaining, properties, application of copper, silver, gold.
22. Preparation, properties of metal oxides, bases, salts – normal, acidic, basic, double, complex compounds.
23. Hydrolysis of salts.
24. Redox reactions.
25. General characteristics of compounds of elements of the IA and IIA groups.
26. General characteristics of the elements of the VIIA group (halogens).
27. General characteristics of the elements of the VIAGROUP (chalcogenes).
28. Features of oxygen chemistry. Ozone. Water and hydrogen peroxide. Structure and properties.
29. Features of sulfur chemistry. Hydrogen sulfide. Sulfur oxides. Oxygen acids. Salts: sulfites, sulfates, thiosulfates. Peroxosulfates.
30. General characteristics of the elements of the VA group. Electronic structure, degrees of oxidation, the most important hydrogen and oxygen compounds in the nitrogen - bismuth series. Salt. Properties of simple substances.

31. General characteristics of the elements of the IVA group. Electronic structure, degrees of oxidation, the most important hydrogen and oxygen compounds in the carbon-lead series. Salt. Properties of simple substances.

32. Features of carbon chemistry. Methane, acetylene; preparation and properties. Carbides. Carbon monoxide, carbon dioxide, carbonic acid; carbonate and bicarbonates. Carbamide, cyanamide, hydrogen cyanide and hydrogen thiocyanate.

33. The chemistry of silicon. Receiving. Interaction with alkalis and hydrogen fluoride. Silane and silicides. Silicon dioxide, orthosilicic acid, silicates.

#### **Assessment criteria (assessment tool — Control questions)**

Grade	Assessment criteria
outstanding	A high level of training, impeccable command of theoretical material, the student demonstrates a creative approach to solving non-standard situations. The student gave a complete and detailed answer to all the theoretical questions of the ticket, confirming the theoretical material with practical examples. The student actively worked in practical classes. 100% completion of control exam tasks.
excellent	High level of training with minor mistakes. The student gave a complete and detailed answer to all the theoretical questions of the ticket, confirms the theoretical material with practical examples. The student actively worked in practical classes. Completion of control exam tasks by 90% and above.
very good	Good preparation. The student gives an answer to all the theoretical questions of the ticket, but there are inaccuracies in the definitions of concepts, processes, etc. The student actively worked in practical classes. Completion of control exam tasks from 80 to 90%.
good	In general, good preparation with noticeable mistakes or shortcomings. The student gives a complete answer to all theoretical questions of the ticket, but there are inaccuracies in the definitions of concepts, processes, etc. Mistakes are made when answering additional and clarifying questions from the examiner. The student worked in practical classes. Completion of control exam tasks from 70 to 80%.
satisfactory	Minimum sufficient level of training. The student shows a minimum level of theoretical knowledge, makes significant mistakes, but when answering leading questions, he can orient himself correctly and give the correct answer in general terms. The student attended practical classes. Completion of control exam tasks from 50 to 70%.
unsatisfactory	The preparation is insufficient and requires additional study of the material. The student gives erroneous answers, both to the theoretical questions of the ticket, and to the leading and additional questions of the examiner. The student missed most of the practical classes. Completion of control exam tasks up to 50%.
poor	The preparation is absolutely insufficient. The student does not answer the questions posed. The student was absent from most lectures and practical classes. The completion of control exam tasks is less than 20%.

## **6. Учебно-методическое и информационное обеспечение дисциплины (модуля)**

Основная литература:

1. Капустина А. А. Общая и неорганическая химия. Практикум : учебное пособие для спо / Капустина А. А., Хальченко И. Г., Либанов В. В.; Хальченко И. Г., Либанов В. В. - 3-е изд., стер. - Санкт-Петербург : Лань, 2023. - 152 с. - Книга из коллекции Лань - Химия. - ISBN 978-5-507-45513-3., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=882337&idb=0>.

Дополнительная литература:

1. Гаршин Анатолий Петрович. Общая и неорганическая химия в схемах, рисунках, таблицах, химических реакциях : Учебное пособие / Санкт-Петербургский государственный политехнический университет Петра Великого. - 2. - Москва : ООО "Научно-издательский центр ИНФРА-М", 2024. - 304 с. - (Высшее образование). - Профессиональное образование. - ISBN 978-5-16-018765-5. - ISBN 978-5-16-108333-8., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=874850&idb=0>.

Программное обеспечение и Интернет-ресурсы (в соответствии с содержанием дисциплины):

ЭБС «Юрайт». Режим доступа: <http://biblio-online.ru>.

ЭБС «Консультант студента». Режим доступа: <http://www.studentlibrary.ru>.

ЭБС «Лань». Режим доступа: <http://e.lanbook.com/>.

ЭБС «Znanium.com». Режим доступа: [www.znanium.com](http://www.znanium.com).

## **7. Материально-техническое обеспечение дисциплины (модуля)**

Учебные аудитории для проведения учебных занятий, предусмотренных образовательной программой, оснащены мультимедийным оборудованием (проектор, экран), техническими средствами обучения.

Помещения для самостоятельной работы обучающихся оснащены компьютерной техникой с возможностью подключения к сети "Интернет" и обеспечены доступом в электронную информационно-образовательную среду.

Программа составлена в соответствии с требованиями ФГОС ВО по направлению подготовки/специальности 31.05.03 - Dentistry.

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