

Документ подписан простой электронной подписью
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**Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University**

Faculty of Science

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

DISCIPLINE SYLLABUS

Chemistry of heterocyclic compounds
discipline title

Recommended by the Didactic Council for the Education Field of:

04.04.01 «Chemistry»
field of studies / speciality code and title

The student's discipline is implemented within the professional education programme of higher education:

Modern integrative chemistry
higher education programme profile/specialisation title

2025 г.

1. DISCIPLINE GOAL

The goal of the Discipline is to develop systematic knowledge about the patterns in the chemical behavior of the main classes of heterocyclic compounds in connection with their structure in order to use this knowledge as the basis for studying molecular level processes occurring in nature and living systems.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The discipline implementation is aimed at the development of the following competences (competences in part):

Table 2.1. List of competences that students acquire during the discipline.

Competence code	Competence descriptor	Competence formation indicators (within this course)
PC-1	Ability to develop a work plan and to choose adequate methods for solving research problems in the chosen field of chemistry, chemical technology or sciences related to chemistry	PC-1.2. Ability to select experimental and calculation-theoretical methods for solving the problems based on the available material and time resources
PC-2	Ability, based on a critical analysis of the results of research and development, to evaluate the prospects for their practical application and continuation of work in the chosen field of chemistry, chemical technology or sciences related to chemistry.	PC-2.1. Ability to systematize information obtained in the course of research and development, to analyze it and compare it with literature data.
		PC-2.2. Ability to determine possible directions for the development of work and prospects for the practical application of the results obtained

3. DISCIPLINE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline refers to the elective component of (B1) block of the higher educational programme curriculum.

Within the higher education programme students also master other disciplines and / or internships that contribute to the achievement of the expected learning outcomes as results of the discipline.

Table 3.1. The list of the higher education programme components that contribute to the achievement of the expected learning outcomes as the discipline results.

Competence code	Competence descriptor	Previous courses/modules, discipline*	Subsequent courses/modules, discipline*
PC-1	Ability to develop a work plan and to choose adequate	Actual problems of modern chemistry Organization and	Research work Pre-diploma internship

Competence code	Competence descriptor	Previous courses/modules, discipline*	Subsequent courses/modules, discipline*
	methods for solving research problems in the chosen field of chemistry, chemical technology or sciences related to chemistry	planning of scientific research Theory and problems of physical chemistry Data analysis in chemistry Chemistry of nanostructured systems Module: Selected chapters of the main areas of chemistry Module: Modern problems of chemistry Scientific seminar Completing a master's thesis	
PC-2	Ability, based on a critical analysis of the results of research and development, to evaluate the prospects for their practical application and continuation of work in the chosen field of chemistry, chemical technology or sciences related to chemistry.	Organization and planning of scientific research Scientific seminar Completing a master's thesis	Research work Pre-diploma internship

* To be filled in according with the competence matrix of the higher education programme.

4. DISCIPLINE WORKLOAD

The total workload of the discipline is 5 credits (180 academic hours).

Table 4.1. Types of educational work by periods of mastering the educational program for FULL-time education

Type of educational work	TOTAL, ac.h.	Semester(s)			
		1	2	3	4
<i>Contact work, ac.h.</i>	72			72	
including:					
Lectures	36			36	
Laboratory work	36			36	
Practical / seminar classes					
<i>Independent work of students, ac.h.</i>	72			72	
<i>Control (exam / test with assessment), ac.h.</i>	36			36	
Total labor intensity of the discipline	ac.h.			180	
	c.u.			5	

5. DISCIPLINE CONTENTS

Table 5.1. Discipline contents*

Name of the discipline section	Content of the section (topics)	Type of educational work
Module 1. Introduction. Nomenclature of heterocyclic compounds. Small cycles	Classification of heterocycles	LC, LW
	Nomenclature of heterocyclic compounds.	LC, LW
	Small cycles	LC, LW
Module 2. Five-membered heterocyclic compounds with one heteroatom	Pyrrole, furan, thiophene	LC, LW
	Indole, indolizine	LC, LW
Module 3. Five-membered heterocycles with two heteroatoms	1,3-Azoles: imidazole, oxazole, thiazole	LC, LW
	1,2-Azoles: pyrazole, isoxazole, isothiazole	LC, LW
Module 4. Six-membered heterocyclic compounds	Six-membered hetarenes: pyridine, azines and benzazines	LC, LW
	Quinoline, isoquinoline	LC, LW

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

6. DISCIPLINE 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)
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a blackboard (screen) and technical means of multimedia presentations.	Projector, motorized screen for projectors, Wi-Fi
Lab work	A classroom for laboratory work, individual consultations, current and mid-term assessment; equipped with a set of specialised furniture and machinery.	A set of specialized furniture; specialized equipment of the chemical laboratory: fume hood SHVP-4, fume hood SHVP-2, rotary evaporator Hei-value digital G3B, rotary evaporator IKA, digital devices for determining the melting point SMP10; electronic laboratory scales AND EK-610, MK-M flask heaters of different volumes, drying cabinet, magnetic stirrer MRHei-Mix S, magnetic stirrer with heating MRHei-Standart,

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
		refractometer, combined laboratory water bath, vacuum chemical station RS3001 VARIO-pro, circulation cooler Rotacool Mini, rotary plate pump vacuum RZ2.5, membrane vacuum chemical pump MZ2CNT, Steinel thermal air blower, Spectroline UV lamp, electronic vacuum controller with CVC3000 detect Vacuumbrand valve, stainless steel emergency cabin SHVV, chemical dishes, refrigerator; wi-fi
Self-studies	A classroom for self-studies (can be used for seminars and consultations), equipped with a set of specialised furniture and computers with access to the electronic information and educational environment.	

* The premises for students' self-studies are subject to **MANDATORY** mention

7. RESOURCES RECOMMENDED FOR DISCIPLINE

Main readings:

1. Yurovskaya M. A. Chemistry of aromatic heterocyclic compounds - 3rd ed. - Moscow: Knowledge Laboratory, 2021. - (Textbook for higher school).
<https://lib.rudn.ru/MegaPro/Web/SearchResult/ToPage/1>
2. J. Joule, M. Mills Chemistry of heterocyclic compounds, Moscow, Mir, 2004
3. T. Gilchrist Chemistry of heterocyclic compounds, Moscow, Mir, 1996.

Additional readings:

1. L. A. Gaivoronskaya Five-membered heterocycles. Text of lectures on the special course "Chemistry of heterocyclic compounds", Moscow, UDN, 1981.

Internet sources

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System (RUDN ELS)
<http://lib.rudn.ru/MegaPro/Web>
- EL "University Library Online" <http://www.biblioclub.ru>
- EL "Yurayt" <http://www.biblio-online.ru>
- EL "Student Consultant" www.studentlibrary.ru
- EL "Lan" <http://e.lanbook.com/>

- EL "Trinity Bridge"

2. Databases and search engines:

- Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- Scopus abstract database <http://www.elsevierscience.ru/products/scopus/>
- Reaxys database <https://www.reaxys.com/#/search>

The training toolkit and guidelines for a student to do discipline:*

1. A course of lectures on the discipline “Chemistry of heterocyclic compounds.”
2. Laboratory practical work.
3. Materials for preparing for final tests.

*The training toolkit and guidelines for the discipline are placed on the discipline page in the university telecommunication training and information system under the set procedure.

DEVELOPERS:

Head of Organic Chemistry

Voskressensky L.G

Department

position, educational department

signature

name and surname.

**HEAD OF EDUCATIONAL
DEPARTMENT:**

Organic Chemistry Department

Voskressensky L.G

name of department

signature

name and surname

**HEAD OF HIGHER EDUCATION
PROGRAMME:**

Dean of Faculty of Science,

Head of Organic Chemistry

Voskressensky L.G

Department

position, department

signature

name and surname