

**NATIONAL ACADEMY OF SCIENCES OF UKRAINE
V.P. KUKHAR INSTITUTE OF BIOORGANIC CHEMISTRY AND PETROCHEMISTRY**

Approved

by the decision of the Scientific Council
of the V. P. Kukhar Institute of Bioorganic
Chemistry and Petrochemistry
of the NAS of Ukraine
protocol No. 4
of April 21, 2017.

Approved

Chairman of the Scientific Council,
Director of the V. P. Kukhar Institute of
Bioorganic Chemistry and Petrochemistry
of the NAS of Ukraine
Corr. Member of the NAS of Ukraine

_____A.I. Vovk

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EDUCATIONAL-SCIENTIFIC PROGRAM

Level of higher education:	the third (educational-scientific) level
Field of science:	10 “Natural Sciences”
Program subject area:	102 “Chemistry”
Field of study:	Bioorganic chemistry; Petrochemistry and Coal chemistry
Higher educational degree:	Doctor of Philosophy

The educational-scientific program is a normative document which contains the system of educational components of the third educational and scientific level of higher education within the Program subject area 102 "Chemistry", field of study "Bioorganic chemistry" and "Petrochemistry and Coal chemistry", which defines the requirements for the level of education for a "Doctor of Philosophy" Degree. The educational-scientific program takes into account the requirements of the Law of Ukraine "On Higher Education" dated March 13, 2016, and the "Draft of Higher Education Standard of Ukraine for the third educational and scientific level of higher education degree - Doctor of Philosophy" in Program subject area 102 "Chemistry" approved by the order of the Cabinet of Ministers of Ukraine No. 266 dated March 23, 2016.

The Program corresponds to the third educational and scientific level of higher education and the eighth level of the standard classification from National Classifier of Occupations.

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INTRODUCTION

The Law of Ukraine "On Higher Education" (Article 10) stipulates that the standard of higher education is a set of requirements for the content and results of educational activities of higher education institutions and research institutions at each level of higher education within each specialty.

Educational activity in the field of higher education is carried out by universities and research institutions (for training specialists of the degree of Doctor of Philosophy) on the basis of licenses issued by the central executive body in the field of education and science in the manner prescribed by the Cabinet of Ministers of Ukraine. .

The standard of higher education defines the following requirements for the educational program: a) the amount of ECTS credits required to obtain the appropriate degree of higher education; b) a list of competencies of the graduate; c) normative content of training of higher education seekers, formulated in terms of learning outcomes; d) forms of certification of applicants for higher education; e) requirements for the existence of a system of internal quality assurance of higher education; f) requirements of professional standards (if any).

The third (educational and scientific) level of higher education corresponds to the eighth qualification level of the National Qualifications Framework and provides for the acquisition of theoretical knowledge, skills, abilities and other competencies sufficient to produce new ideas, solve complex problems in professional and / or research and innovation. activities, mastering the methodology of scientific and pedagogical activities, as well as conducting their own scientific research, the results of which have scientific novelty, theoretical and practical significance.

The scientific institution on the basis of the educational-scientific program (ESP) on each specialty develops the curriculum which defines: 1) the list and volume of educational disciplines in ECTS credits; 2) the sequence of study disciplines; 3) forms of training and their scope; 4) the schedule of the educational process; 5) forms of current and final control. To specify the planning of the educational process for each academic year, a working curriculum is drawn up, which is approved by the head of the scientific institution.

According to Art. 1 "Basic terms and their definitions" of the Law of Ukraine "On Higher Education" educational program is a system of educational components at the appropriate level of higher education within the specialty, which determines the requirements for the level of education of persons who can start studying under this program. the logical sequence of their study, the number of ECTS credits required for the implementation of this program, as well as the expected learning outcomes (competencies), which must be mastered by the applicant for the appropriate degree of higher education.

ESP is used during the accreditation of the educational program, inspection of educational activities by specialty and specialization; curriculum development, curricula and practices; development of diagnostic tools for the quality of higher education; determining the content of training in the system of retraining and advanced training; as well as professional orientation of applicants.

ONP takes into account the requirements of the Law of Ukraine "On Higher Education", the National Qualifications Framework, approved by the Cabinet of Ministers of Ukraine from 23.11.2011 № 1341, "Procedure for training applicants for higher education degrees of Doctor of Philosophy and Doctor of Science in higher education (scientific institutions)", approved Resolution of the Cabinet of Ministers of Ukraine of 23.03.2016 № 261 and establishes: the scope and timing of the educational component of the educational and scientific program of training a doctor of philosophy; general competencies; professional competencies; program learning outcomes; the list and scope of academic disciplines for mastering the competencies of the educational program; requirements for the structure of academic disciplines, etc.

1. FIELD OF USE

The users of the educational and scientific program are applicants for the degree of Doctor of Philosophy, who study at the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine (IBOPC NAS of Ukraine), scientific and pedagogical workers who train the candidates for the degree of Doctor

philosophy of the relevant specialty.

ESP is used for: drawing up curricula and working curricula; formation of individual plans for candidates for the degree of Doctor of Philosophy; formation of programs of educational disciplines; determining the information base for assessing the quality of education; accreditation of the educational

program; internal and external quality control of training; semester controls of candidates for the degree of Doctor of Philosophy in the relevant specialty.

2. REGULATORY REFERENCES

1. Law of Ukraine "On Higher Education" - <http://zakon4.rada.gov.ua/laws/show/1556-18>.
2. National Classifier of Ukraine: "Classifier of Professions" DK 003: 2010 // Publishing House "Sotsinform", - K.: 2010.
3. List of branches of knowledge and specialties - <http://zakon4.rada.gov.ua/laws/show/266-2015-p>.
4. Development of educational programs: methodical recommendations - http://ihed.org.ua/images/biblioteka/rozroblennya_osv_program_2014_tempusoffice.pdf.
5. National qualifications framework. Appendix to the Resolution of the Cabinet of Ministers of Ukraine dated 23.11.2011 № 1341.
6. Resolution of the Cabinet of Ministers of Ukraine of April 26, 2015 № 266 "List of branches of knowledge and specialties for which higher education students are trained."
7. Resolution of the Cabinet of Ministers of Ukraine dated 23.03.2016 № 261 "On approval of the Procedure for training higher education candidates for the degree of Doctor of Philosophy and Doctor of Science in higher educational institutions (scientific institutions)".

3. TERMS AND DEFINITIONS

Certification is the establishment of compliance of the level and volume of knowledge, skills and other competencies acquired by higher education students with the requirements of higher education standards.

Field of knowledge - the main subject area of education and science, which includes a group of related specialties for which training is carried out.

The Doctor of Philosophy is an educational and at the same time the first scientific degree obtained at the third level of higher education on the basis of a master's degree. The degree of Doctor of Philosophy is awarded by a specialized academic council of a higher education institution or research institution as a result of successful completion of the relevant educational and scientific program by the applicant and public defense of the dissertation in a specialized academic council.

The European Credit Transfer and Accumulation System (ECTS) is a credit transfer and accumulation system used in the European Higher Education Area to provide, recognize, validate qualifications and educational components and to promote the academic mobility of higher education applicants. The system is based on determining the study load of the higher education student, necessary to achieve certain learning outcomes, and is accounted for in ECTS credits.

Qualification - the official result of assessment and recognition, which is obtained when the authorized institution has established that the person has achieved competencies (learning outcomes) in accordance with the standards of higher education, as evidenced by the relevant document on higher education.

Competence is a dynamic combination of knowledge, skills and practical skills, ways of thinking, professional, ideological and civic qualities, moral and ethical values, which determines a person's ability to successfully carry out professional and further educational activities and is the result of higher education.

ECTS credit is a unit of measurement of the amount of study load of a higher education applicant, necessary to achieve certain (expected) learning outcomes. The volume of one ECTS credit is 30 hours.

The national qualifications framework is a systematic and competency-based description of qualification levels.

Educational (educational-professional or educational-scientific) program (ONP) - a system of educational components at the appropriate level of higher education within the specialty, which determines the requirements for the level of education of persons who can start studying under this program, the list of disciplines and their logical sequence study, the number of ECTS credits required to complete this program, as well as the expected learning outcomes (competencies) that must be mastered by the applicant for the relevant degree.

Learning outcomes - a set of knowledge, skills, abilities, other competencies acquired by a person in the process of learning a certain educational and scientific program, which can be identified, quantified and measured.

Specialty - a component of the field of knowledge in which training is carried out.

Quality of higher education - the level of knowledge, skills, abilities and other competencies acquired by a person, which reflects his / her competence in accordance with the standards of higher education.

4. PROFILE OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

GENERAL INFORMATION	
Full name of the scientific institution	Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine
Full name of the qualification	Doctor of Philosophy in Chemistry
Type of diploma and scope of work	Doctor of Philosophy, first degree, 4 academic years, 43 ECTS credits
Accrediting institution	Ministry of Education and Science of Ukraine, Ukraine, Victory Avenue, 10, Kyiv, 01135
Accreditation period	2017 year
Program level	QF for EHEA - third cycle, EQF for LLL - 8 level; NRC of Ukraine - level 8
Languages of instruction	Ukrainian. Russian or English for foreigners
Basic concepts and their definition	The program uses basic concepts and their definitions in accordance with the Law of Ukraine "On Higher Education"
A The purpose of the program	
	The purpose of the educational and scientific program is to prepare doctors of philosophy in the field of natural sciences in the specialty "Chemistry", which is provided by acquiring theoretical knowledge, skills and other competencies sufficient to produce new ideas, solving complex problems in professional and / or research and innovation activities, mastering the methodology of scientific and pedagogical activities, as well as the implementation of original research in the form of a dissertation, the results of which have scientific novelty, theoretical and practical significance; scientific, educational, informational support of graduate students during the preparation and defense of the dissertation.
B Program features	
1	<p>Subject area (field of knowledge)</p> <p>Natural Sciences 102 Chemistry Specializations: bioorganic chemistry; petrochemistry and coal chemistry</p>
2	<p>Program focus: general/ special</p> <p>The third (educational and scientific) level of higher education according to the Law of Ukraine "On Higher Education", the eighth qualification level of the National Qualifications Framework.</p> <p>Research on priority areas of bioorganic chemistry and petrochemistry and coal chemistry:</p> <ul style="list-style-type: none"> - research methods in bioorganic chemistry; bioorganic synthesis of natural compounds; structure and functions of natural biopolymers; proteins, enzymes, nucleic acids, polysaccharides; methods of obtaining natural compounds; biopolymers as therapeutically important targets; mechanisms of reactivity of biomolecules in model systems; catalysis in bioorganic chemistry; the relationship between the structure and activity of bioactive compounds; methods of computer modeling of bioactivity, QSAR methods, molecular docking; - the latest methods of fine organic synthesis; synthesis of bioactive compounds of heterocyclic and organophosphorus nature; five- and six-membered heterocycles and their condensed derivatives; synthesis of new derivatives of oxazoles and thiazoles; radical processes; stereoselective methods of forming new bonds in bioactive molecules

	<p>and starting reagents; the use of multifunctional reagents to obtain heterocyclic compounds; use of enzymes as natural catalysts for stereoselective synthesis of organic compounds; elemental analogues of natural bioactive compounds containing phosphorus and fluorine atoms;</p> <p>- processes for obtaining functional derivatives of hydrocarbons: oxidation, hydration, carbonylation, halogenation, nitration, sulfonation; catalysts for the processes of obtaining functional derivatives of hydrocarbons; thermodynamic and kinetic bases of processes of obtaining functional derivatives of hydrocarbons;</p> <p>- pokhodzhennya nafty, yiyi sklad ta fizyko-khimichni vlastyvoli; klasyfikatsiya i suchasni metody doslidzhennya naft; osnovni zavdannya naftopererobnoyi ta naftokhimichnoyi promyslovosti; osnovni vydy tovarnykh produktiv pererobky nafty; problemy hlybyny pererobky nafty ta utylizatsiyi pobichnykh produktiv ta vidkhodiv; naftovi palyva ta yikh zahal'ni kharakterystyky; osnovni napryamky i metody pererobky horyuchykh kopalyn dlya oderzhannya vysokoyakisnykh palyv i khimichnoyi syrovyny; - istoriya rozvytku ta isnuyuchi teoriyi katalizu; stadiyi ta osoblyvosti prokhozheniya heterohenno-katalitychnoho protsesu; tekhnolohichni kharakterystyky tverdykh katalizatoriv; konstruktyvni osoblyvosti reaktoriv dlya provedennya katalitychnykh protsesiv; spetsyfichni osoblyvosti riznykh vydiv katalizu u naftopererobtsi ta naftokhimiyi; - metody pererobky vuhillya do vuhlevodnevoyi syrovyny; metody hazyfikatsiyi vuhillya, napivkoksuvannya ta koksuvannya; protses Fishera-Tropsha; protsesy pererobky pryrodnykh haziv, horyuchykh slantsiv, torfu, produktsiyi tvarynnoho i roslynnoho pokhodzhennya; - syntetychnyy benzyn, spytovi palyva, biodyzel', biohaz, tverde biopalyvo, dzherela yikhnoho oderzhannya; biomasa - syrovyna dlya khimichnoyi promyslovosti; fermentni tekhnolohiyi pereroblennya biomasy na khimichni produkty; - osnovni oznaky i osoblyvosti budovy poverkhnevo-aktyvnykh rechovyn (PAR); klasyfikatsiya i osnovni typy PAR ta metody yikh syntezu na osnovi naftokhimichnoyi i vidnovlyuval'noyi syrovyny; teoriyi mitseloutvorennya v rozchynakh PAR; rozroblennya efektyvnykh kompozytsiynykh system i tekhnolohiy yikh praktychnoho vykorystannya. - syntez, vlastyvoli i zastosuvannya monomeriv i polimeriv na yikh osnovi; suchasni fizyko-khimichni metody doslidzhennya monomeriv ta polimeriv; vplyv funktsional'nykh hrup na vlastyvoli polimeriv.</p> <p>- origin of oil, its composition and physicochemical properties; classification and modern methods of oil research; main tasks of oil refining and petrochemical industry; main types of commodity products of oil refining; problems of depth of oil refining and utilization of by-products and waste; petroleum fuels and their general characteristics; main directions and methods of processing of combustible minerals to obtain high-quality fuels and chemical raw materials; - history of development and existing theories of catalysis; stages and features of the heterogeneous catalytic process; technological characteristics of solid catalysts; design features of reactors for catalytic processes; specific features of different types of catalysis in oil refining and petrochemistry;</p> <p>- methods of processing coal into hydrocarbons; methods of coal gasification, semi-coking and coking; the Fischer-Tropsch process;</p>
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		<p>processes of processing natural gases, oil shale, peat, products of animal and vegetable origin; - synthetic gasoline, alcohol fuels, biodiesel, biogas, solid biofuels, sources of their production; biomass - raw materials for the chemical industry; enzyme technologies for processing biomass into chemical products; - the main features and characteristics of the structure of surfactants (surfactants); classification and main types of surfactants and methods of their synthesis based on petrochemical and reducing raw materials; theories of micelle formation in surfactant solutions; development of effective composite systems and technologies for their practical use. - synthesis, properties and application of monomers and polymers based on them; modern physicochemical methods for the study of monomers and polymers; the influence of functional groups on the properties of polymers.</p>
3	Orientation of the program	<p>Educational, research and applied. Basic research and production of new knowledge in the field of chemistry, including the development of methods and / or technologies for obtaining new substances and materials with promising functional properties and processes with their participation, which will have practical application.</p>
4	Features of the program	<p>Educational component of the program. The program is implemented in small groups of researchers. The program provides a differentiated approach to full-time and part-time graduate students and applicants. The program provides 30 ECTS credits for compulsory disciplines, of which 18 ECTS credits are disciplines of general training (philosophy, foreign language of professional orientation, methodology and organization of scientific research), which provide for the acquisition of general scientific (philosophical), language competencies, universal researcher skills.</p> <p>Scientific component of the program. The scientific component of the educational and scientific program involves the implementation of their own research under the guidance of one or two supervisors with the appropriate design of the results in the form of a dissertation. This component of the program is not measured by ECTS credits, but is drawn up separately in the form of an individual plan of research work of the graduate student and is an integral part of the curriculum. The program provides mastering of theoretical and practical tools of scientific research in the field of chemistry and focuses on cooperation with institutions of the Ministry of Education and Science of Ukraine, international organizations, foreign universities and research institutions, the business sector.</p>
C	Employment and continuing education	
1	Employment eligibility	<p>Research and teaching activities in the field of chemistry. Scientific, administrative and managerial activities in science, education, government at all levels and the business sector. Professions according to the classifier of professions of Ukraine: Legislators, senior civil servants, leaders, managers (managers). Heads of enterprises, institutions, organizations (12): heads of enterprises, institutions, organizations (Director) (1210.1), heads of various main divisions (Head) (1229.1), heads of functional divisions (Head) (1231). Head of Research Unit (1237), Chief Specialist of Research Unit (1237.1), Head (Head) of Research Unit (1237.2), Head of Projects and Programs (1238), Head of Other Functional Units (1239),</p>

		<p>Head of Small Enterprises (Director) (13).</p> <p>Professionals: chemistry professionals (2113): researchers (chemistry) (2113.1), chemists (2113.2); teachers of universities and higher educational institutions (2310): Professors and associate professors (2310.1), other teachers of universities and higher educational institutions (2310.2). Consultant, professional in innovation, professional in intellectual property, specialist in economic modeling of ecological systems, specialist in certification, standardization and quality (2419.2); Research Fellow in Marketing, Entrepreneurship Efficiency, Intellectual Property and Innovation (2419.1), Research Fellow in Project and Program Management (2447.1)</p> <p>Jobs. Positions in departments and laboratories of scientific institutions, profile departments of universities. Relevant jobs (research and management) of enterprises, institutions and organizations.</p>
2	Further training	<p>Training for development and self-improvement in scientific and professional spheres of activity, as well as in other related branches of scientific knowledge:</p> <ul style="list-style-type: none"> - preparation at the 9th qualification level of the National Qualifications Framework in the field of natural sciences; - training at the 8th qualification level of the National Qualifications Framework in related specialties; - educational programs, research grants and scholarships that contain additional scientific and educational components.
D	Learning style and methods	
1	Approaches to teaching and training	<p>The main approaches to teaching and learning graduate students are:</p> <ul style="list-style-type: none"> - use of lectures, seminars and practical classes in the planned disciplines; - independent work with sources of information in the library of the Institute and in scientific libraries of Ukraine; - use of distance learning courses and electronic resources via the Internet; - individual consultations of specialists of the Institute, other institutions of the National Academy of Sciences of Ukraine, faculties of chemical profile of higher educational institutions, leading specialists of the chemical industry; - information support for the participation of graduate students in competitions for scientific scholarships and grants; - active work of graduate students in groups for the implementation of state budget and other topics, projects of competitive programs, including international, participation in the development of reporting materials, registration and accounting documents, registration of patents.
2	Evaluation system	<p>The system of assessment of knowledge of the educational program provides for the implementation of current and final control.</p> <p>Current control is carried out in the form of work in practical classes, speeches at seminars and conferences, preparation of scientific reports.</p> <p>Final control involves a differentiated test or oral exam. The graduate student is considered admitted to the final control in the disciplines of the educational and scientific program, if he has performed all types of work provided for in the curriculum in this discipline.</p>
3	Form of control	Postgraduate students / applicants undergo annual certification by

	of postgraduate study success / applicants	<p>reporting to the profile department and the Academic Council of the Institute on the progress of the educational and scientific program and individual plan of scientific work, including published scientific articles and speeches at conferences.</p> <p>The end result of postgraduate / applicants' training is: full implementation of the educational-scientific program, list of scientific works published based on research results, including in foreign editions and indexed in scientometric databases, approbation of results at scientific conferences, properly executed dissertation manuscript and defense (or acceptance for defense by a specialized scientific council) of a dissertation for the degree of Doctor of Philosophy in the field of 10 - Natural Sciences, specialty 102 - Chemistry.</p>
E		Program competencies
1	Integral competence	<p>Ability to solve complex problems in the field of professional and / or research and innovation, which involves a deep rethinking of existing and the creation of new holistic knowledge and / or professional practice.</p>
2	General competencies	<p>GC1. Ability to scientific and professional foreign language speech. Ability to use a foreign language to present scientific results in oral and written forms, to understand foreign scientific and professional texts for communication in foreign scientific and professional environments.</p> <p>GC2. Ability to present the main problems of philosophy in a holistic way at the level of an objective, ideologically unbiased modern vision.</p> <p>GC3. Ability to abstract thinking, analysis and synthesis. Ability to critically analyze, evaluate existing knowledge, synthesize new and complex ideas based on logical arguments and verified facts.</p> <p>GC4. Ability to apply knowledge in practical situations. Gaining flexibility of thinking, open to the application of acquired chemical knowledge to solve strategic and current problems of industrial development, as well as to the application of acquired knowledge in practical situations.</p> <p>GC5. Ability to conduct independent research. Acquisition of competencies for initiating and performing research that provides an opportunity to rethink existing and gain new knowledge.</p> <p>GC6. Art. Ability to generate new ideas, abstract thinking, achieve scientific goals, find the best solutions in new conditions and situations.</p> <p>GC7. Ability to work in a team. Ability to perform research in a group, understanding the responsibility for performance, discipline requirements, planning and time management. Ability to develop and manage research projects, make proposals for research funding.</p> <p>GC8. Communication skills. Ability to communicate with different target audiences, present complex information in a convenient and understandable way, present the results of their own research orally and in writing, using appropriate vocabulary, methods, information and communication technologies and technical means.</p> <p>GC9. Ethical attitudes. Adherence to ethical principles in research, honesty and integrity in professional activities and daily life.</p> <p>GC10. Ability to search, process and analyze information from various sources.</p> <p>GC11. Ability to work in the international scientific space. Ability</p>

		<p>to work in a large international group, to respect national and cultural traditions, ways of working of other members of the group.</p> <p>GC12. Teaching and promotion skills. Ability to communicate with non-specialists, certain skills of organizing and conducting training sessions.</p> <p>GC13. Management skills. Ability to work in conditions of limited time and resources, motivate and manage the work of others to achieve goals.</p>
3	Special (professional) competencies	<p>SC1. In-depth knowledge of the specialty. Knowledge and understanding of the advanced level in the field of chemistry and related fields, including methods of conducting experiments, the level of this knowledge should be sufficient for research at the level of the latest world achievements and aimed at their expansion and deepening.</p> <p>SC2. Research abilities. Ability to formulate at the present level a scientific problem, working hypotheses of the researched problem, to carry out original researches in the field of chemistry, to reach scientific results which create new integral knowledge, to solve problems and problems by understanding their fundamental bases and use of both theoretical and experimental methods. , mastered from the educational and scientific program.</p> <p>SC3. Technological capabilities. Ability to select and use scientific equipment, the latest information and communication technologies and procedures related to chemical and physico-chemical research methods.</p> <p>SC4. Ability to critically analyze and evaluate data. Ability to analyze the data of experiments, including the use of computer technology, interpret the results of experiments and participate in discussions about the scientific and practical significance of the results.</p> <p>SC5. Skills of presenting the results of own research and conducting discussions orally and in writing.</p> <p>SC6. Ability to plan, design and implement research projects, make proposals for research funding.</p> <p>SC7. Ability to self-development and self-improvement. Ability to learn new branches of science through independent learning, using the acquired professional knowledge, skills and abilities.</p> <p>SC8. Skills in the use of information technology and related software for research and interpretation of their results.</p>
F	Program learning outcomes	
	<ul style="list-style-type: none"> - Knowledge of a foreign (English) language, at a level sufficient to present and discuss the results of their scientific work in oral and written forms, full understanding of professional scientific texts in chemistry, ability and skills to communicate in a foreign scientific and professional environment. - Mastering general scientific (philosophical) competencies aimed at forming a systematic scientific worldview, professional ethics and general cultural outlook. - Skills of oral and written presentation of the results of own research and discussions in written and oral form. - Knowledge and ability to use modern information and communication technologies, computer tools and programs in scientific research. - Knowledge of research methods and the ability to use them at the appropriate level; ability to search, process, analyze and synthesize the received information (scientific articles, scientific-analytical materials, databases, etc.). 	

- Ability to search and review information in the professional literature using a variety of resources: journals, online resources, the ability to work with modern bibliographic and abstract databases, as well as scientometric platforms.
- Ability to plan, design and carry out research / projects from the task setting stage to the consideration and evaluation of the results obtained, including the ability to select the appropriate techniques, procedures and techniques.
- Deep knowledge and understanding in a particular field of chemistry. Critical analysis of literature data, knowledge of potential risks, limitations and costs of scientific work. Argumentation of the realism of the plan. Scientific strategies in case of negative results. Drawing up alternative plans.
- Demonstration of knowledge and understanding of basic facts, concepts, theories related to bioorganic chemistry and petrochemistry and coal chemistry. Assessment of the available potential for research work. Preparation of a dissertation project. Ability to conduct scientific seminars and publish scientific articles in leading professional journals in the field of chemistry.
- Gaining experience in the process of discussion at seminars and colloquia reviews of special literature and the results of experimental research, as well as developing a culture of dialogue and accumulation of communicative experience.
- Ability to clearly and effectively describe large, deep and detailed results of scientific work.
- Achieving relevant knowledge, understanding and ability to use methods of data analysis and statistics at the latest level.
- Mastering the latest physico-chemical methods for studying the properties of substances and the structure of their molecules.
- Assimilation of basic concepts, understanding of theoretical and practical problems, history of development and current state of scientific knowledge in the field of chemistry, mastery of modern chemical terminology and nomenclature in the research area.
- Knowledge of basic laws of chemistry, modern theories of atomic structure, chemical bonding and molecule structure, patterns of changes in chemical properties of compounds, ability to use basic laws of chemistry to explain the properties and reactivity of biologically active compounds and processes involving them.
- Knowledge of purposeful synthesis of low molecular weight synthetic regulators of model biological processes; knowledge of the mechanisms of reactivity of biomolecules in model systems; knowledge of the structure and function of peptides and proteins; knowledge of the mechanisms of enzymatic catalysis and regulation of the activity of enzymes and other biopolymers; knowledge of the principles of searching for potential bioregulators and pharmaceuticals, molecular targets for determining bioactivity; the ability to establish a relationship between the structure and activity of bioactive compounds; ability to use computer methods of bioactivity modeling, QSAR methods, molecular docking.
- Knowledge of the latest methods of fine organic synthesis that significantly simplify the synthesis of biologically active compounds: CH substitutions in organic compounds, cross-condensation methods, combinatorial and multicomponent transformations, cyclocondensation of functionally substituted heterocycles; photoinitiated and selective radical processes; knowledge of stereoselective methods of forming new bonds in bioactive molecules and starting reagents as important components for achieving biological activity; ability to use enzymes as natural catalysts for stereoselective synthesis of organic compounds, ability to use ionic liquids, microwave and ultrasonic radiation, reactions in water and "flow" processes, ability to use plant raw materials as a basis for new "basic" chemicals and as sources of valuable natural compounds .
- Knowledge of methods for the synthesis of five- and six-membered heterocycles and their condensed derivatives containing pharmacophore substituents.
- Knowledge of methods for obtaining element-organic analogues of natural bioactive compounds containing phosphorus and fluorine atoms.
- Knowledge of the specifics of homogeneous and heterogeneous chemical reactions; theoretical provisions of chemical kinetics of homogeneous and heterogeneous processes;

chemical equilibrium; the nature of phase transitions; technological characteristics of solid catalysts; ability to use methods of intensification of chemical-technological processes.

- Knowledge of chemical and industrial classification of modern methods of oil research; organization of oil refining and petrochemical productions; main types of commodity products of oil refining; main types of heterogeneous and homogeneous processes in oil refining and petrochemistry, as well as catalysts for their implementation; problems of depth of oil refining and utilization of by-products and waste; petroleum fuels and their general characteristics.

- Knowledge of the history of chemical fuel technology and the most important deposits of combustible minerals; structures of use of energy raw materials in the world and in Ukraine; main directions and methods of processing of combustible minerals to obtain high-quality fuels and chemical raw materials.

- Knowledge of natural resources in Ukraine and around the world; prospects for their production, productivity and development of processing industries with the involvement of by-products; main directions and methods of processing of agricultural raw materials, by-products and by-products of petrochemical, oil and fat, food and meat and dairy industries to obtain environmentally friendly fuels and lubricants, surfactants and intermediates for organic synthesis and other industries.

- Knowledge of the activation of different classes of hydrocarbons by different types of catalysts and mechanisms of hydrocarbon transformations; kinetic methods of reaction research; specific features of catalysis on zeolites; basic reactions catalyzed by aluminosilicates; reasons for deactivation of catalysts.

- Knowledge of the main features and characteristics of the structure of surfactants, their classification, the main types and methods of synthesis based on petrochemical and reducing raw materials; theories of micelle formation in surfactant solutions; the influence of chemical structure and other factors on the critical concentration of micelle formation, colloid-chemical and practically important properties in solutions and composite systems; ability to use instrumental methods to create composite systems with predefined properties for their practical use.

- Knowledge of coal processing methods to hydrocarbons; methods of coal gasification, semi-coking and coking; the Fischer-Tropsch process; processes of processing natural gases, oil shale, peat, products of animal and vegetable origin.

- Knowledge of synthesis methods, properties and application of monomers and polymers based on them; modern physicochemical methods for the study of monomers and polymers; the influence of functional groups on the properties of polymers.

- Knowledge of physico-chemical methods of proving the structure of organic matter.

- Knowledge of general regulations on labor protection, safety requirements for storage, packaging, dispensing and transportation of chemical reagents, safety requirements when working with glassware and appliances.

- Ability to prepare and successfully defend a dissertation on the basis of individual research, as well as to use and recognize the results of other members of the research group.

5. EDUCATIONAL COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

The educational and scientific program (ESP) provides the following cycles of training, which provides the educational and qualification level of training of a doctor of philosophy:

- cycle of general training disciplines;
- cycle of disciplines of professional training;
- practical training;
- certification.

The educational part of the program provides normative disciplines of professional training and natural sciences (fundamental), humanities, socio-economic and psychological-pedagogical disciplines and provides the educational level of a doctor of philosophy in chemistry.

Curricula of disciplines in the professional direction of the Doctor of Philosophy are oriented in the direction of increasing their fundamentality, scientific and professional level, they include the latest achievements of the relevant scientific field.

The distribution of the content of the educational component by type of educational activity is given in table 1.

Table 1. Distribution of the content of the educational component

Plan of the educational process	Competences	Loans ECTS
1. CYCLE OF GENERAL TRAINING DISCIPLINES		
EC 1.00 Required EP components		
EC 1.01. Foreign language for professional purposes	GC1, GC11	8
EC 1.02. Philosophy of science and culture	GC2, GC3, GC9, GC12, SC2	6
EC 1.03. Methodology and organization of scientific research	GC3, GC5, GC6, GC10, GC13, SC5, SC6	4
TWO 1.00. Selective components of the EP. List №1 (1 discipline from the list)		
EC 1.01. Development of a dissertation project	GC7, GC8, GC12, SC2, SC7	3
EC 1.02. Postgraduate research seminar	GC7, GC8, GC12, SC2, SC5	3
TOTAL		21
2. CYCLE OF VOCATIONAL TRAINING DISCIPLINES		
EC 2.00. Required EP components		
EC 2.01. Fundamentals of bioorganic chemistry	GC4, GC5, SC1, SC2, SC7	4
EC 2.02. General issues of petrochemistry and coal chemistry	GC4, GC5, SC1, SC2, SC7	4
EC 2.03. Physico-chemical methods for studying the structure of molecules.	GC4, GC10, SC3, SC4, SC8	4
EC 2.00. Disciplines of free choice of graduate student (2 disciplines from the list). List №2. Elective specialization courses "Bioorganic Chemistry"		
EC O 2.01. Molecular mechanisms in bioorganic chemistry	GC4, SC1, SC2, SC4	4
EC 2.02. The latest methods of organic synthesis of bioactive compounds	GC4, SC1, SC2, SC4	4
EC 2.03. Bioactive organometallic compounds	GC4, SC1, SC2, SC4	4
EC 2.04. Fundamentals of chemistry of natural compounds	GC4, SC1, SC2, SC4	4
List №3. Elective courses in "Petrochemistry and Coal Chemistry"		
EC 2.05. Catalytic processes of oil refining	GC4, SC1, SC2, SC4	4
EC 2.06. Alternative raw materials for organic and petrochemical synthesis	GC4, SC1, SC2, SC4	4
EC 2.07. Monomers and polymers in organic and petrochemical synthesis	GC4, SC1, SC2, SC4	4
EC O 2.08. Surfactants - synthesis, properties, applications	GC4, SC1, SC2, SC4	4
TOTAL		20
3. PRACTICAL TRAINING		
EC S 3.01. Scientific and pedagogical practice	GC7, GC8, GC12, SC5	2
TOTAL		2
4. CERTIFICATION		
EC 4.01. Qualification certification	-	-
TOGETHER		43

6. SCIENTIFIC COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

The research work of graduate students is a mandatory component of the training of highly qualified specialists (doctors of philosophy), able to independently conduct scientific research, creatively solve specific professional, scientific problems. Credits are not accounted for.

The scientific component includes conducting basic and (or) applied research in higher education and / or research institution, preparation for public defense of a dissertation research, the topic of which is determined by the relevant scientific unit and approved by the Academic Council of the Institute, writing and publishing articles and testing results. dissertation research, in accordance with the current requirements approved by the Ministry of Education and Science of Ukraine.

The research work of the graduate student is carried out under the guidance of the supervisor, can be divided into preparatory and main stages and includes the following activities. At the preparatory stage, the graduate student:

1. Selects the topic of research and justifies the relevance of the chosen research topic. Revises the catalogs of defended dissertations and gets acquainted with the dissertations already performed in the department / laboratory. Processes the latest research results in selected and related fields of science. Gets acquainted with analytical reviews and articles in professional journals, consults with experts in order to identify little-studied scientific problems and issues that are relevant. Studies and analyzes the main approaches and positions of scientific schools and trends in solving the problem under study; clarifies the terminology in the chosen field of knowledge. Searches for literary sources on the selected topic.

2. Carries out planning of the dissertation work by drawing up the individual plan of the postgraduate student; postgraduate work plan.

3. Carries out the purpose and tasks of dissertation work. Defines the object and subject of scientific research.

4. Selects methods (techniques) of research.

During the main stage of research, the graduate student:

1. Conducts research work in accordance with the profile of ONP graduate school, using the knowledge and skills acquired during the study of fundamental and applied disciplines of the educational component of the program. Engaged in scientific work aimed at performing the theoretical and practical part of the study.

2. Analyzes and summarizes the results of scientific research on the basis of modern interdisciplinary approaches, application of scientific methodological principles and research methods, use of thematic information resources in research, leading domestic and foreign experience in research.

3. Prepares and publishes publications on the topic of the dissertation: monographs and scientific publications in domestic professional publications, the list of which is approved by the central executive body in the field of education and science and publications included in international scientometric databases, scientific publications in other publications.

4. Carries out approbation of results of scientific researches by participation in scientific conferences: international and foreign, all-Ukrainian, regional and interuniversity, and also in scientific seminars. Participates in competitions of scientific works.

5. Participates in the activities of the Council of Young Scientists of the Institute.

6. Involved in the implementation of state budget or other topics in the framework of state, academic grants, as well as work plans of scientific departments of the Institute.

7. If the invention was obtained according to the scientific results of scientific research, the graduate student prepares and submits documents for obtaining a patent for an invention (copyright certificate).

8. The ability to shape the structure of scientific work, including dissertation, to carry out its rubrication and contents filling.

9. Passes the preliminary examination of the dissertation in the department / laboratory and at the meeting of the sections of the Academic Council of the Institute (pre-defense).

10. Engaged in the preparation of the dissertation manuscript.

11. Present the results of the research in the form of a dissertation, defend the results of the dissertation research in public at a meeting of a specialized academic council.

Research work is reflected in the individual training plan of the graduate student. Control over the implementation of the individual training plan is carried out by certification. Attestation of graduate students is carried out in accordance with the curriculum for doctors of philosophy in the specialty. Certification of graduate students is held once a year at a meeting of the Academic Council of the

Institute. The attestation of the graduate student takes into account the fulfillment of program requirements of both the educational and scientific components of the educational and scientific program. Graduate students who have successfully passed the annual certification are transferred to the next year of study. Graduate students who have not passed the certification are subject to expulsion.

7. SCIENTIFIC AND PEDAGOGICAL PRACTICE

Scientific and pedagogical practice is a mandatory component of the ONP training of doctors of philosophy in the specialty 102 "Chemistry" at the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine. It aims to provide the graduate student with professional skills and abilities of a teacher of higher education.

Practice of practical skills and abilities of the postgraduate student to carry out preparation of educational and methodical maintenance, preparation and carrying out of occupations, within disciplines taught by the scientific adviser, occurs during passing of scientific and pedagogical practice that is provided by the curriculum on the fourth year of study. third educational level of education.

The purpose of scientific and pedagogical practice is to deepen and consolidate the knowledge of graduate students on the organization and forms of the educational process in modern conditions, its scientific, educational and methodological and regulatory support, the formation of skills and abilities to develop scientific and information sources in preparation of classes, active teaching methods, professionally-oriented disciplines of the relevant professional field and disciplines of the fundamental cycle for the specialty 102 "Chemistry".

Scientific and pedagogical practice should be close to the areas of research of the graduate student. During this practice there is an opportunity to test the results of research conducted by the graduate student when writing a dissertation.

According to the curriculum for doctors of philosophy, scientific and pedagogical practice is conducted in the fourth year of study in the amount of 60 hours. (2 credits), including at least 12 hours of seminar, practical or laboratory classes with first-year graduate students.

Passage of scientific and pedagogical practice involves the postgraduate student to perform the following types of work:

- preparation and holding of seminars;
- preparation of educational and methodical support for conducting seminars;
- development of tasks and organization of independent work of first-year graduate students in the subjects taught;
- preparation of educational and methodological support for credit tests and exams in the disciplines taught;

The test on scientific and pedagogical practice takes place before the members of the commission, which is created by the order of the director of the Institute.

8. QUALIFICATION CERTIFICATION OF THE POSTGRADUATE STUDENT

Certification of graduate students is carried out in accordance with the curriculum for doctors of philosophy in chemistry. In the process of training doctors of philosophy use two forms of certification: intermediate and final. According to the current legal documents of the Ministry of Education and Science of Ukraine and the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine, the final certification of graduates graduating from the educational and scientific programs of Doctor of Philosophy is mandatory.

8.1. Intermediate certification

The purpose of the intermediate attestation is to control the implementation of the individual plan of the graduate student for all components provided by the curriculum. Intermediate certification includes three modules: 1) theoretical, 2) research, 3) practical.

8.1.1. Certification according to the theoretical module involves taking exams in accordance with the curriculum for the preparation of doctors of philosophy in the specialty 102 "Chemistry". The composition of the examination commission and the chairman is appointed by the order of the director after the full implementation of the program of educational and scientific level of Doctor of Philosophy in order to establish the actual compliance of the level of theoretical training with the requirements of general and professional competencies.

8.1.2. The research module, according to the initial plan, provides for the current certification of graduate students once a year. The purpose of the intermediate certification is to monitor the

implementation of the individual plan of research and compliance with the schedule of preparation of research results.

8.1.3. The practical module, according to the initial plan, provides for scientific and pedagogical practice in the fourth year of study. The purpose of the intermediate attestation for the practical component is to control the implementation of the individual plan and the acquisition by the graduate student of professional skills and abilities of a teacher of a higher educational institution.

8.2. Final certification

The purpose of the final certification is to establish compliance of the level of educational and scientific training of graduate students with the requirements of the ESP of the Doctor of Philosophy in the specialty of chemistry. The form of final certification is public defense of the results of research work, which are presented in the form of a dissertation. It allows you to establish compliance with the level of research training of graduate students and the requirements for a doctor of philosophy in chemistry.

The final attestation in the form of public defense of the dissertation is carried out by the Specialized Academic Council, the composition of which is approved by the Ministry of Education and Science of Ukraine on the basis of current regulations. In some cases, in accordance with the Law of Ukraine "On Higher Education" of 01.07.2014 (Articles 6.3, 30.5.5) creates a one-time specialized academic council consisting of 6-7 specialists of the relevant profile, of which at least two must be employees of other higher education institutions or research institutions. The staff of such a council is approved by the National Agency for Quality Assurance in Higher Education.

The dissertation work of the Doctor of Philosophy in Chemistry is the main research and professional qualification function, which is expressed in the ability of the Ph.D. It is the result of independent research work of the graduate student and has the status of an intellectual product on the rights of the manuscript.

The final certification of graduate students who have fully completed the ESP training of doctors of philosophy in graduate school of the Institute of Bioorganic Chemistry and Petrochemistry of the NAS of Ukraine in specialty 102 "Chemistry", ends with the award of the degree "Doctor of Philosophy" in natural sciences about the level of education and qualification.

Table 2. Matrix of the ratio of competencies to the disciplines of the curriculum in the specialty 102 "Chemistry"

№ п/п	Curriculum discipline	General competencies											Special competencies									
		GC1	GC2	GC3	GC4	GC5	GC6	GC7	GC8	GC9	GC10	GC11	GC12	GC13	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8
Mandatory part of the plan																						
1	Foreign language for professional purposes	•																				
2	Philosophy of science and culture		•	•					•							•						
3	Methodology and organization of scientific research			•		•	•				•								•	•		
4	Fundamentals of bioorganic chemistry				•	•									•	•					•	
5	General issues of petrochemistry and coal chemistry				•	•									•	•					•	
6	Physico-chemical methods for studying the structure of molecules				•						•						•	•				•
7	Scientific and pedagogical practice							•	•										•			
№ п/п	Curriculum discipline	General competencies											Special competencies									
		GC1	GC2	GC3	GC4	GC5	GC6	GC7	GC8	GC9	GC10	GC11	GC12	GC13	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8
Selective part of the plan																						
8	Development of a dissertation project							•	•							•						•
9	Postgraduate research seminar							•	•							•			•			
10	Molecular mechanisms in bioorganic chemistry				•										•	•			•			
11	The latest methods of organic synthesis of bioactive compounds				•										•	•			•			
12	Bioactive organometallic compounds				•										•	•			•			
13	Fundamentals of chemistry of natural compounds				•										•	•			•			
14	Catalytic processes of oil refining				•										•	•			•			
15	Alternative raw materials for organic and petrochemical synthesis				•										•	•			•			
16	Monomers and polymers in organic and petrochemical synthesis				•										•	•			•			
17	Surfactants - synthesis, properties, applications				•										•	•			•			

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