

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

**TERNOPIL VOLODYMYR HNATIUK NATIONAL PEDAGOGICAL
UNIVERSITY**

EDUCATIONAL AND PROFESSIONAL PROGRAM

«102 CHEMISTRY»

THE SECOND (MASTER'S) LEVEL OF HIGHER EDUCATION

IN SPECIALTY 102 CHEMISTRY

THE FIELD OF KNOWLEDGE 10 Natural Sciences

QUALIFICATION: Master of Chemistry. Chemist. Lecturer in Chemistry.

APPROVED BY THE ACADEMIC COUNCIL

The Head of the Academic Council

_____/V. P. Kravets

(protocol №13 dated June «27» 2017)

Educational program enacts from

September «01» 2017

(order №178-p dated August «26» 2017)

Ternopil 2017

1. Profile of the educational and professional program

in specialty 102 Chemistry

1 - General information	
Full name of higher educational institution and structural unit	Ternopil Volodymyr Hnatyuk National Pedagogical University, Ternopil, Kryvonosa st. 2, 46027, Faculty of Chemistry and Biology, the Department of Chemistry and Methods of Its Teaching
The degree of higher education and the name of the qualification in the language of the original	The second level of higher education. Master of Chemistry. Chemist. Lecture in Chemistry.
The official name of the educational program	The educational and professional Master's program in specialty 102 Chemistry
Type of diploma and the volume of the educational program	The master's degree, unitary, 90 ECTS credits, the term of study – 1 year and 4 months
Availability of accreditation	The validity of the certificate of accreditation - until July 1, 2025
Cycle/Level	NRC (NQF – National Qualification Framework) of Ukraine – level 7, FQ-EHEA – second cycle, EQF-LLL – level 7
Prerequisites	Availability of the bachelor's degree in chemistry or the bachelor of education
Teaching languages	Ukrainian
The duration of the educational program	until 01.07.2025
Internet address of the permanent description of the educational program	http://tnpu.edu.ua/about/public_inform/akredytatsiia%20ta%20litsenzuvannia/102_Chemistry_magister.pdf
2 – The purpose of the educational program	
To create an educational environment for a second-level higher education student for the formation of general and professional competencies of a master in chemistry, enabling him to obtain free access to employment in the sphere of scientific research in chemistry and profile school and the possibility of the continuation of the studies on the PhD program.	

3 – Characteristics of the educational program	
Subject area (branch of knowledge, specialty, specialization)	Natural sciences, chemistry; Branch of knowledge – 10 Natural sciences; Specialty: 102 Chemistry. The training program consists of 2 cycles and a state certification: • general training cycle (15 ECTS credits, 450 hours); • a cycle of professional training (75 ECTS credits, 2250 hours); - o normative educational disciplines (34 ECTS credits, 1020 hours); - o selective educational disciplines (20 ECTS credits, 600 hours); - o practical training (21 ECTS credits, 630 hours).
Orientation of the educational program	Educational and professional, has applied orientation. Provides training for the fulfillment of the functional duties of a chemist-reasercher, a chemist-laboratory assistant in scientific institutions, a teacher, of chemical disciplines of higher educational institutions, a teacher of chemistry of a higher (profile) general secondary school, formation of readiness for self-education and professional self-improvement during a lifetime.
The main focus of the educational program and specialization	General education with research elements, based on a broad review and deep knowledge of various fields of chemical science, their integration in solving socially oriented tasks, assessment of current achievements in chemical science, the search for ways to implement basic and applied scientific research in the field of chemistry. Problems of teaching chemical subjects in higher educational institutions and teaching chemistry in the profile school. <i>Key words:</i> higher education, master's degree, chemist, teacher, natural sciences, chemistry.
Peculiarities of the program	Interdisciplinary and multidisciplinary training of professionals in in the field of knowledge 10 Natural Sciences. The program is aimed at creating professional competences of the Master of Chemistry with an access to employment in the field of research in chemistry and in the profile and high school, the possibility of continuing the study under the program of the doctor of philosophy. The program provides for the training of a teacher of chemical disciplines in higher education institutions and a chemistry teacher who is capable of implementing an educational process in senior grades in different fields and

	with different levels of educational content (standard, academic and profile). Provides introduction of terminological foreign vocabulary for professional orientation, conducting of separate study courses in English, international mobility. The program is implemented in an active educational environment.																																																			
4 – Eligibility of graduates for employment and further training																																																				
Eligibility for employment	Scientific and research institutions, higher educational institutions of the I-IV levels of accreditation, secondary (basic) and high (profile) school. Scientific positions in the field of communication, management and research. The position of a teacher and a teacher in profile and high schools.																																																			
	The specialist is trained to work in the field of economics according to SC 009:2010																																																			
	<table><tr><td>Code</td><td>Name</td><td>ISIC</td></tr><tr><td>M</td><td>PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES</td><td>M</td></tr><tr><td>72</td><td>Scientific research and development</td><td>72</td></tr><tr><td>72.1</td><td>Research and experimental development in the field of natural and technical sciences</td><td>721</td></tr><tr><td>72.19</td><td>Research and experimental development in the field of other natural and technical sciences</td><td>7210</td></tr><tr><td>74</td><td>Other professional, scientific and technical activities</td><td>74</td></tr><tr><td>74.9</td><td>Other professional, scientific and technical activities</td><td>749</td></tr><tr><td>74.90</td><td>Other professional, scientific and technical activities</td><td>7490</td></tr><tr><td>P</td><td>EDUCATION</td><td>P</td></tr><tr><td>85</td><td>Education</td><td>85</td></tr><tr><td>85.3</td><td>Secondary Education</td><td>852</td></tr><tr><td>85.31</td><td>General Secondary Education</td><td>8521</td></tr><tr><td>85.32</td><td>Vocational and technical education</td><td>8522</td></tr><tr><td>85.4</td><td>Higher Education</td><td>853</td></tr><tr><td>85.41</td><td>Vocational education at the level of higher vocational education and training institution</td><td>8530</td></tr><tr><td>85.42</td><td>Higher Education</td><td>8530</td></tr><tr><td>85.6</td><td>Additional activities in the field of education</td><td>8550</td></tr></table>	Code	Name	ISIC	M	PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	M	72	Scientific research and development	72	72.1	Research and experimental development in the field of natural and technical sciences	721	72.19	Research and experimental development in the field of other natural and technical sciences	7210	74	Other professional, scientific and technical activities	74	74.9	Other professional, scientific and technical activities	749	74.90	Other professional, scientific and technical activities	7490	P	EDUCATION	P	85	Education	85	85.3	Secondary Education	852	85.31	General Secondary Education	8521	85.32	Vocational and technical education	8522	85.4	Higher Education	853	85.41	Vocational education at the level of higher vocational education and training institution	8530	85.42	Higher Education	8530	85.6	Additional activities in the field of education	8550
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				the field of physics, astronomy, meteorology and chemistry
	2113.1		Researcher-Consultant (Chemistry)	Researcher-Consultant (Chemistry)
	2113.2		Chemist	Chemist
	23			Teachers
	231			Teachers of universities and higher education institutions
	232			Teachers of secondary educational institutions
	2320	25157	Teacher of a secondary educational institution	
	2320	23473	Methodologist of extramural schools and departments	
	2351.1	23667	Researcher (teaching methods)	Researchers (teaching methods)
	2351.1		Researcher-consultant (teaching methods)	Researchers (teaching methods)
	2351.2		Methodist	Other professionals in the field of teaching methods
	2352	22517	Inspector of higher educational establishments	Educational institutions inspectors
	2359.2	23160	Lecturer	Lecturer
	2359.2	23471	Methodist	Methodist of an out-of-school institution
	31			Technical specialists in the field of applied sciences and engineering
	311			Technical specialists in the field of physical sciences and engineering
	3111	23157	Laboratory assistant (chemical and physical research)	Laboratory assistants and technicians related to chemical and physical research
Further training	The possibility to study according to the program of the third (educational and scientific) level of higher education.			

	Degree in Doctor of Philosophy in the field of Natural Sciences
5 – Teaching and assessment	
Teaching and studying	<i>Basic approaches:</i> student centered, activity, value; electronic, distance and self-study. <i>Educational technologies:</i> problem-developing, interactive, informational and communicative, project, contextual education.
Assessment	Credit and module system, which provides for student assessment of all types of classroom and non-classroom educational activities: current, module, final control. Written and oral examinations, tests, presentations, practice notes, defense of master's thesis.
6 – Program competencies	
Integral competency	IC. The ability to comprehensively solve complex professional and practical problems in the field of chemistry, in the field of research in chemistry and in profile and high school.
General Competencies	GC1 The ability to understand the essence, structure of science and philosophical and methodological problems of scientific knowledge. GC2 The ability to critically analyze and evaluate existing scientific theories, concepts and paradigms. GC3 The ability to generate ideas when solving professional and practical tasks. GC4 The ability to communicate in a foreign language (orally and in writing) within the limits of professional interests. GC5 The ability to take responsibility and manage the work of the team, maintaining an atmosphere of kindness and creativity in international and multicultural groups. GC6 The ability to apply acquired knowledge in practical situations, critically evaluate their own activities, to professionally develop. GC7 The ability to productive interpersonal communication. GC8 The ability to interdisciplinary interaction and cooperation with representatives of other branches of knowledge in the process of solving scientific research and applied problems. GC9 The ability to provide comprehensive information in a concise form, orally and in writing, using information and communication technologies and relevant scientific categories in the category of philosophy and terms of the

	natural sciences. GC10 The ability to work independently on solving scientific and applied problems, to develop strategies and to determine the time frame of implementation of stages of work; the ability to direct the effort, combining the results of various studies and analyzes, timely submit the results. GC11 The ability to form a system of necessary indicators, analyze, synthesize, evaluate, interpret information for problem identification and search for the best ways to solve them in life situations and in professional activities. GC12 The ability to built theoretical and methodological constructs and general algorithm for a specific scientific research or scientific project. GC13 The ability to object-oriented use of electronic resources, to work with modern software products for the purpose of searching, processing and analysis of information from various sources, the use of electronic databases for the accumulation and storage of various information, modeling the structure and prediction of properties of substances.
Professional competencies of the specialty	PC1 The ability to understand and solve professional and scientific and pedagogical problems, while maintaining a critical attitude towards established scientific concepts. PC2 The ability to use the knowledge of theoretical concepts, laws, concepts, teachings and theories of chemistry as the basis for the characterization and analysis of chemical phenomena and processes. PC3 The ability to characterize physico-chemical and chemical properties of coordination, organic, organometric and high-molecular compounds based on their structure. PC4 The ability to use methods of quantum and chemical calculations to predict the structure and properties of chemical compounds. PC5 The ability to choose the optimal direction of synthesis of organic compounds, to select the conditions for their production and methods of separation and purification. PC6 The ability to interpret the mechanisms of chemical reactions and determine the influence of various factors on their dynamics, to use physical and chemical laws to predict the direction and develop the conditions for the implementation of the chemical process. PC7 The ability to organize research activities in the field of directed synthesis of substances with practical properties. PC8 The ability to choose directions for the synthesis of biologically active compounds and use methods for

	assessing their physiological activity. PC9 The ability to identify organic compounds based on qualitative reactions and results of physical and modern physico-chemical methods of analysis. PC10 The ability to use mathematical methods of statistical data processing and chemometric methods of planning experimental research. PC11 The ability to analyze migration and transformation of chemical substances in biological systems, to choose methods and to control the parameters of the environment. PC12 The ability to search for specialized literature, to advise and critically use scientific databases and other relevant sources of information on various aspects of the study of chemical and chemical and biological phenomena. PC13 The ability to conduct scientific expertise of various projects in the field of chemistry and related industries, to develop proposals for their improvement and implementation. PC14 Ability to organize the educational process with students on the basis of personality-oriented, activity and competence approaches, the ability to understand the main problems of modern chemical education in Ukraine and to find ways to improve the educational process. PC15 The ability to build an individual trajectory for the training and upbringing of students on the basis of knowledge about individual and psychological and age-old personality features. PC16 The ability to compose the psychological and pedagogical characteristics of the students of a group and class students for the purpose of planning the educational process in chemistry. PC17 The ability to compile a thematic plan, choose the technology of conducting classes and educational activities. PC18 The ability to critically analyze and assess the pedagogical experience of teachers of chemistry. PC19 The ability to introduce innovative technologies into the educational process in the study of chemical disciplines. PC20 The ability to analyze and formulate scientific and pedagogical problems, to offer their solutions by decomposition into components that can be investigated separately in their more or less important aspects. PC21 The ability to provide safe conditions for the organization of the educational process on chemistry in universities and secondary schools.
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7 – Program outcomes of studying	
Knowledge and understanding	POS1 Knowledge of the main directions, problems, theories and methods of philosophy, the content of modern philosophical discussions on the problems of the philosophy of science and the methodology of scientific knowledge. POS2 Knowledge of the basic stages of the development of science, the sequence and internal logic of the formation of basic concepts and laws of chemistry. POS3 Understanding the causal relationships of the development of society and their ability to use them in professional and social activities, the ability to apply modern scientific and technological achievements of world culture and civilization. POS4 Knowledge and awareness of civil, administrative and criminal liability for violation of copyright and related rights in the field of professional activity. POS5 Understanding of basic chemical concepts for explaining the structure and chemical properties of organic and inorganic compounds (elementorganic, coordination and macromolecular compounds), theoretical foundations of modern organic chemistry and basic methods for the transformation of functional groups. POS6 Knowledge of theoretical foundations of methods of synthesis, identification and establishment of the structure of inorganic and organic substances. POS7 Knowledge of the specifics of objects and methods of analytical control of the state of biological systems and environmental parameters. POS8 Understanding of current trends in the synthesis of biologically active compounds and biological screening methods. POS9 Knowledge of theoretical fundamentals of chemistry teaching methods in senior and high school: general model of chemistry teaching, systems of teaching and control methods; systems of teaching and their didactic capabilities, organizational forms of teaching chemistry. POS10 Understanding the essence and content of modern chemistry teaching techniques in upper and lower secondary schools, including distance education. POS11 Knowledge of methodical approaches to the formation of students and experimental skills in chemistry. POS12 Understanding the principles of creating didactic support and choosing methodological approaches to studying specific topics and sections of chemistry in senior

	and high school. POS13 Knowledge of functions, powers and responsibilities of educational institutions in the conditions of expansion of financial independence, ways to search for possible sources of increase of resources for ensuring the functioning of educational institutions.
Applying Knowledge and Understanding	POS14 The ability to establish connections between professional knowledge and general philosophical concepts. POS15 The ability to conduct conversation and discussion in a foreign language within scientific subjects, observing grammatical and phonetic norms. POS 16. The ability to work with foreign-language original literature, translate professional texts from the native language into foreign and foreign languages into native, to refer and annotate scientific literature, to initiate a dialogue in a situation of professional communication. POS17 The ability to search scientific publications on chemical issues in international editions, to create presentations using a foreign language. POS18 The ability to choose rational methods for normalizing working conditions in a general educational institution. POS19 The ability to characterize the physical and chemical and chemical properties of organic, organometallic, coordination and macromolecular compounds based on their structure. POS20 The ability to choose and apply methods of organic synthesis, analysis and quality control and environmental status. POS21 The ability to apply methods of chemical modeling and quantum and chemical calculations to predict the structure and properties of substances. POS22 The ability to use mathematical methods for statistical processing of data in order to interpret the results of experimental studies. POS23 The ability to design and implement technology of lectures, practical, laboratory classes on chemical disciplines and chemistry lessons. POS24 The ability to implement an individual and differentiated approach to students and students in the process of studying chemical disciplines. POS25 The ability to carry out problem-based learning based on awareness of its didactic principles, combine it with other types of learning. POS26 The ability to organize the project activity of

	students and students, to form their experimental skills and abilities. POS27 The ability to analyze the content and structure of syllabuses and chemistry textbooks for senior and high school with the purpose of implementing the relevant learning objectives. POS28 The ability to define the main tasks, plan and complete the master's thesis, use the final competencies to prepare and execute the research plan in accordance with the specified time frame.
8 – Resource support for the implementation of the program	
Personnel support	Project group: 2 doctors of sciences (1 in chemical sciences, 1 – biological), 1 candidate of chemical sciences, associate professor. Guarantor of educational program: V.C. Baranovsky – candidate of chemical sciences, associate professor. The program involves scientific and pedagogical staff with academic degrees and academic status. In order to increase the professional level, all scientific and pedagogical workers undergo an internship once in five years, including abroad ones.
Material and technical support	Profile teaching laboratories, offices, laboratories of integrated training, research laboratories of the department of chemistry and methods of its training.
Information and studying and methodological support	Availability of sufficient quantity of educational and methodical literature, periodicals, electronic educational and methodical complexes of educational disciplines (on the platform of Moodle)
9 — Academic mobility	
National Credit Mobility	Carried out by individual contracts of participants in the educational process
International Credit Mobility	Higher pedagogical school named Victor Frankel Carinthia, Austria (Agreement 06.02.2009 - 01.07.2020); Jan Dlugosz University in Czestochowa, Poland (Agreement 10.10. 2016 - Unlimited)
Studying of foreign applicants for higher education	—

2. List of components of the educational and professional program and their logical consistency

2.1. List of components of educational and professional program

Code/ №	Components of the educational program (educational disciplines, course projects (work), practice, qualification work)	Number of credits	Assessment form
1	2	3	4
OBJECTIVE COMPONENTS OF EDUCATIONAL PROGRAM			
OC1.1.01	Management in education	3	Exam
OC1.1.02	Philosophy of science	3	Exam
OC1.1.03	Computer information technologies in education and science (workshop)	3	Credit
OC1.1.04	Methodology of scientific research	3	Exam
OC1.1.05	Foreign language (according to professional orientation)	3	Exam
OC2.1.01	Psychology and pedagogy of higher education	3	Exam
OC2.1.02	Methodology of teaching chemical disciplines at HEI	8	Exam
OC2.1.03	Statistical and chemometric methods in chemistry	5	Credit
OC2.1.04	History of chemistry	4	Credit
OC2.1.05	Supramolecular chemistry	5	Credit
OC2.1.06	Theory and mechanisms of chemical processes	4	Credit
OC2.1.07	Theoretical foundations of organic chemistry	5	Exam
OC2.3.01	Pedagogical practice	6	Credit
OC2.3.02	Scientific and pedagogical practice	9	Credit
OC2.3.03	Master's thesis	6	State exam
Total amount of the required components:		70	
SELECTIVE COMPONENTS OF EDUCATIONAL PROGRAM			
SC2.2.01	Medical and pharmaceutical chemistry	4	Credit
SC2.2.02	Bioanalytic chemistry		
SC2.2.03	Chemistry of organometallic compounds	4	Credit
SC2.2.04	Chemistry of diazo compounds		
SC2.2.05	Coordination chemistry	4	Credit
SC2.2.06	Fundamentals of quantum chemistry		
SC2.2.07	Modern methods of establishing the structure of chemical compounds and materials	4	Exam
SC2.2.08	Methodology of organic synthesis	4	Credit

Total amount of selective components:	20
General amount of educational program	90

3. Form of certification of higher education applicants

Certification of applicants for the educational program in specialty 102 Chemistry is carried out in the form of defence of qualifying master's thesis. Master's work involves conducting independent research or solving a comprehensive specialized problem and / or practical problems in the field of chemistry using theoretical and / or experimental methods.

The qualification master's work must be checked for the absence of plagiarism.

The certification is carried out openly and publicly and ends with the issuance of the diploma of awarding the master's degree with the qualification: Master of Chemistry. Chemist. Lecturer in Chemistry.

