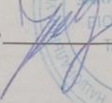


NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE

AGROBIOLOGICAL FACULTY
DEPARTMENT OF ANALYTICAL AND BIOINORGANIC CHEMISTRY &
WATER QUALITY

“APPROVED”

Dean of Faculty of Plant Protection, Biotechnology
and Ecology,

Dr. Agr. Sc., Prof.  Y.V. KOLOMIIEC

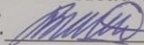
"23" - 05_2024

“REVIEWED AND APPROVED”

At the meeting of the department
of Analytical and Bioinorganic
Chemistry & Water Quality


Protocol #11 "23" 05_2024

Head of the Department

Dr. Chem. Sc., Prof.  V.A. Kopilevich

“REVIEWED”

Guarantor of EP

Dr. Sc., Prof.  M.Y. Pykovskyi

CURRICULUM OF ACADEMIC DISCIPLINE

INORGANIC AND ANALYTICAL CHEMISTRY

Field of knowledge 20 - Agricultural sciences and food

Specialty – 202 “Plant protection and Quarantine”

Education program Plant protection and Quarantine

Faculty of the Plant Protection, Biotechnology and Ecology

Author : Assoc. Prof. R. Lavryk, Ph.D in Chemistry

Kyiv-2024

Description of the discipline
INORGANIC AND ANALYTICAL CHEMISTRY

Field of knowledge, direction, specialty, education and qualification level		
Educational and Qualification level qualification	bachelor	
Specialty	202 “Plant protection and Quarantine”	
Branch of knowledge	20 - Agricultural sciences and food	
Characteristics of training programme		
Type	ordinary	
The total number of academic hours	<u>120</u>	
Number of ECTS credits allocated	<u>4</u>	
Number of modules	<u>4</u>	
Forms of control	Exam	
Indicators of academic discipline for full-time and part-time forms of training course		
	Full-time	Part-time
Year (course)	1	-
Semester	1	-
Number of lectures	45	-
Number of seminars, practical classes		-
Laboratory sessions (activities)	60	-
Independent study	15	-
Number of weekly in-class academic hours for full-time forms of training	8 1	-

1. Aim, objectives, competences and expected learning outcomes of the discipline

Aim is to build a good foundation in chemical knowledge that allows to make qualitative and quantitative inquiries into topics in natural science.

Learning **Objectives are:**

- name ionic and covalent compounds;
- know the properties of acids, bases and salts;
- apply stoichiometry in determining quantity relationships for compounds and chemical reactions;
- demonstrate an understanding of chemical equilibrium;
- understand the structure of matter on atomic and molecular levels and its correlation to chemical and physical properties;
- describe the concentration of a solution in the way that is most appropriate for a particular problem or application;
- use laboratory equipment and make observations to identify chemical and physical changes.

Competencies of the educational programme:

Integrative competency (IC): Ability to solve complex specialized problems and practical problems of professional activity with protection and quarantine of plants and apply theoretical knowledge and methods of phytosanitary monitoring, review, analysis, expertise, which are characterized by complexity and uncertainty of conditions__

General competencies (GC):

- GC1. Ability to abstract thinking, analysis and synthesis
- GC2. Ability to apply knowledge in practical situations__
- Professional (special) competencies (PC):__

Program learning outcomes (ELO) of the educational programme: _

- *ELO_4_Have knowledge of the fundamental sections of higher mathematics, biophysics,*
- *chemistry (analytical, organic, inorganic, physical and colloid), botany and agrozoology to the extent necessary for understanding the processes of the specialty protection and plant quarantine*

2. Programme and structure of the discipline for full-time form of training

Themes and modules to be covered	Number of hours											
	Full-time						Part-time					
	Total	including					Total	including				
		lect.	pract.	lab.	ind.	ind.		1	lect	pract	lab.	ind.
1	2	3	4	5	6	7	8	9	10	11	12	13
Theme module 1. Theoretical foundations of inorganic chemistry												
Theme 1. Introduction. General laws of stoichiometry and types of chemical reactions.	6	2		4			5					
Theme 2. Atomic structure of chemical elements.	6	4		2								
Theme 3. The Periodic Law and Periodic Table of chemical elements.	8	3		5								
Theme 4. Chemical bonding and structure of molecules.	6	2		4								
Theme 5. Chemical kinetics and equilibrium.	2	2		-								
Total with theme module 1.	38	13		15		5						
Theme module 2. Solutions, their nature and properties												
Theme 1. Solutions, their nature and properties.	6	3		2			3					
Theme 2. Electrolytes and reactions in their solutions.	6	3		4								
Theme 3. Hydrolysis of salts.	8	4		4								
Theme 4. Coordination compounds.	6	2		4								
Total with theme module 2.	36	12		14		3						
Theme module 3. Redox reactions. Chemistry of elements												

Theme1.Redox reactions.	8	3		4		2							
Theme 2.Elements of VII-A sub-group.	7	3		2									
Theme 3.Elements of VI-A sub-group.	2	2		2									
Theme4.Elements of V-A sub-group.	7	2		3									
Theme6.General properties of metals.	8	2		2									
Total with theme module3.	34	12		13		2							
Theme module 4. Analytical Chemistry													
Theme1.Analytical chemistry as a science	4	2		2		5							
Theme2. Qualitative analysis	7	3		6									
Theme3.Quantitative analysis	11	3		10									
Total with theme module4.	27	8		18		5							
Totally	120	45		60		15							

3. Topic of laboratory classes

#	Name of theme	Number of hours
1	General rules of activity in chemical laboratory. Rules of laboratory research. Control test – level of the secondary school knowledge.	4
2	Principles of classification of inorganic compounds and these ranges.	2
3	Studying of the chemical properties of different types of inorganic compounds. Control test – classification and properties of inorganic compounds.	4
4	Rules of composition of electronic formulas of the chemical elements, determination of their possible valence and oxidation numbers.	4
5	Types of chemical bonding and structure of molecules of acids, bases, salts, oxides. Control test – compilation of electronic formulas and determination of types of chemical bonding.	2
6	Solutions, their nature and properties. Units of concentration.	2
7	The rules of the chemical reactions compilation in the solutions of electrolytes. Control test: ionic reactions.	4
8	The rules of the chemical reactions compilation of the salts hydrolysis and determination of pH.	2

	Lecture's control test: hydrolysis of salts.	
9	Rules of compilation of red-ox reactions. Control test.	4
10	Rules of compilation of coordinative compounds formulas and reactions with their participation. Studying of their properties. Control test.	2
11	Halogens and their compounds on the example of chlorine and bromine.	4
12	Oxygen, sulfur and their compounds.	4
13	Nitrogen, phosphorus and their compounds. Control Test.	2
14	Chemical properties of the same metals of main and secondary sub-groups. Control Test. The first analytical group of cations	4
15	The second analytical group of cations The third analytical group of cations	3
16	The fourth analytical group of cations. The first analytical group of anions. The second analytical group of anions.	4
17	The third analytical group of anions. Analysis of unknown substances	4
18	Determination of alkali solution normality. Complexometric titration .Permanganatometric determination of Iron(II) content in Mohr's salt.	4
	Totally	60

4. Topic for self-study

#	Name of theme	Number of hours
1	Molar ratios, molar masses, balancing and interpreting equations, conversions between grams and moles. The electronic arrangements and dots-and-crosses diagrams. Atomic number as the basis for the Periodic Law. Long form periodic table.	5
2	Lewis Structures. Exceptions to Regular Lewis Structures - resonance structures. Catalysts and catalysis. Dynamic equilibria. Colligative properties of solution.	3
3	Dilute concentrations units: ppm, ppb, ppt. Use of Hydrolysis in the "Real World". Lewis Acid-Lewis base approach to bonding in complexes. Half-reactions. Nernst Equation.	2
4	Metal halides. Interhalogen compounds. Allotropes of Oxygen and Sulfur. Occurrence of pnictogens. Properties of alkali and alkali-earth	5
	Totally	15

5. Tools for assessing expected learn outcomes:

- Exam;
- Module test;
- Referates;
- Laboratory works;
- Abstracts.
- Presentation of laboratory works.

6. Teaching Methods

- Verbal methods (lecture, interview)
- Practical methods (Laboratory works)
- Visual methods(demonstration methods)
- Independent work (task performance)

7. Assessment methods

Forms of control:

- exam
- test
- control work
- module test
- laboratory work.

8. Distribution of points received by students

Distribution of points received by students. The student's knowledge is assessed on a 100-point scale and translated into national assessments according to the table. 1 "Regulations on examinations and assessments at NUBiP of Ukraine" (order on implementation dated 26.04.2023, protocol No. 10)

The assessment of students' knowledge and skills is conducted by means of a 100-point scale and is converted into national grades according to Table 1 of the current *Exam and Credit Regulations at NULES of Ukraine*.

Student's rating, points	National grading of exams and credits	
	exams	credits
90-100	excellent	pass
74-89	good	
60-73	satisfactorily	
0-59	unsatisfactorily	fail

To determine a student's rating in the discipline R_{DIS} (up to 100 points),

the received assessment rating R_A (up to 30 points) is added to the academic performance rating R_{AP} (up to 70 points): $R_{DIS} = R_{AP} + R_A$.

9. Technology and methodological requirements

1. Inorganic Chemistry. Manual. Voytenko L., Kopilevich V., Prokopchuk N. - Kyiv: NUBiP of Ukraine., 2019. - 148 p.
2. Workbook on Inorganic Chemistry. Voytenko L., Kopilevich V., Prokopchuk N. - Kyiv: NUBiP of Ukraine., 2019. - 85 p.
3. LABORATORY MANUAL ON GENERAL AND INORGANIC CHEMISTRY FOR BACHELOR STUDENTS SPECIALTY 162 – “BIOTECHNOLOGY AND BIOENGINEERING” Voytenko L., Kopilevich V., Prokopchuk N. - Kyiv: NUBiP of Ukraine., 2024. - 203 p.
4. <https://elearn.nubip.edu.ua/course/view.php?id=1185>

10. Recommended sources of information

1. Introduction in General, Organic and Biochemistry, 7th Edition, by Morris Hein, Leo R. Best, Scott Pattison and Susan Arena, Brooks/Cole Publishing Co., 2020, 872 pp.
2. Inorganic and analytical Chemistry, second edition, D. F. Shriver, P. W. Atkins, and C.H. Langford; W. H. Freeman and Co., New York, 2023, 913 pp.
3. <https://elearn.nubip.edu.ua/course/view.php?id=1185>