MINISTRY OF HEALTH OF UKRAINE

ODESSA NATIONAL MEDICAL UNIVERSITY

Faculty of Pharmacy

Department of Pharmaceutical Chemistry and Drug Technology

APPROVED by

Vice-rector for scientific and pedagogical work

_____Eduard BURYACHKIVSKY

_____, 202_

METHODOLOGICAL DEVELOPMENT
TO PRACTICAL LESSONS FROM THE EDUCATIONAL DISCIPLINE

Faculty, course Pharmaceutical, II year

Academic discipline Organic chemistry

(name of academic discipline)

Approved:

The meeting of the department Pharmaceutical chemistry

Odesa National Medical University

Minutes № _ dated _____

Head of Department (_____) Volodymyr GELMBOLDT
(signature) *(Name, last name)*

Developers:

prof. Gelmboldt V.O., docent Lozhichevskaya, T. V., as. Ulizko I.V. as. Shishkin I.O.

Practical lesson No. 1

Topic: The subject of organic chemistry. Classification and nomenclature of organic compounds.

Goal:get acquainted with different types of nomenclature of organic compounds.

Basic concepts: Classification. Functional groups. Classes. Nomenclature systems.

Equipment:visual material, multimedia projector

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
- Requirements for students' theoretical readiness to perform practical classes, the student must know:

- basic provisions of the theory of the structure of organic compounds by O.M. Butlerov;
- rules of different nomenclature;
- features of IUPAC rules; -

the student should be able to:

- to be able to determine the composition of chemical compounds.
- to be able to establish the structure of chemical compounds.
- apply the rules of the systematic nomenclature

List of didactic units:

- textbook text
- a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. What substances are called organic?

2. What is their atomic composition?
3. How do organic compounds differ from inorganic compounds?
4. What is the relationship between organic chemistry and other chemical disciplines?
5. Connection of organic chemistry with special disciplines?
6. How to distinguish an organic substance from an inorganic one?
7. The role of Ukrainian and foreign scientists in the development of organic chemistry.
8. Algorithms for calculating typical problems of pharmaceutical analysis.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
- task content:

1 Name the main methods of imaging organic molecules. Using the appropriate formulas, indicate: a) qualitative and quantitative composition; b) the chemical structure of the following organic substances: propane, cyclopropane, pentene-1, chlorobenzene, diethyl ether.
2 List the main advantages of structural formulas over molecular (gross) formulas.
3 Write all possible structural formulas and give the names of organic substances: C4H8, C2H2, C5H12, C6H6, C3 H7Cl.
- recommendations (instructions) for performing tasks orienting maps for the formation of practical skills

No p.p.	**Main tasks**	**Instructions**	**Answers**
1	**2**	**3**	**4**
1	Functional group	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - p. 11
2	Radical.	Characteristics of the specified	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko

		concepts	I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - p. 16
3	Substitute	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - p. 13

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, the students were introduced to the classifications and nomenclature of organic compounds.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. -

Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1. www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson No. 2

Topic: Types of chemical bonds.

Goal:learn about different types of chemical bonds.

Basic concepts: ionic, covalent, coordination, seven-polar, hydrogen bond.

Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- Quantum mechanical foundations of the theory of chemical bonding.

- Types of hybridization of atomic orbitals of carbon, nitrogen, and oxygen.
- Covalent σ- and π-bonds, their characteristics from the standpoint of the molecular orbital (MO) method.

the student should be able to:

- determine the composition of chemical compounds.

- establish the structure of chemical compounds.

- install eelectronic structure of double and triple carbon-carbon bonds

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

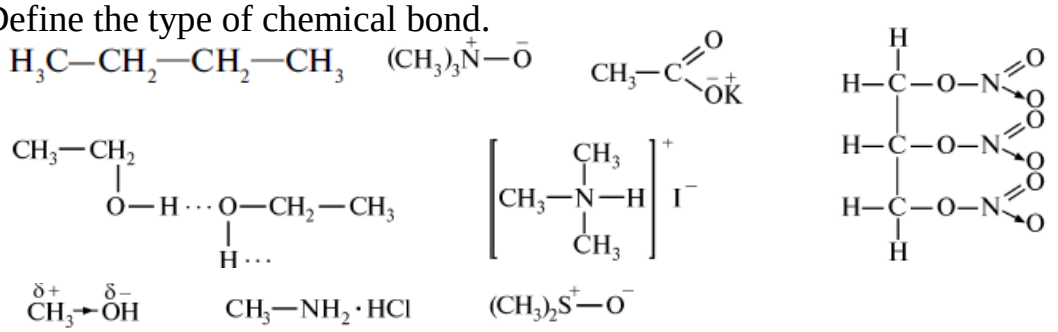
1. Covalent bond.
2. Donor-acceptor bond.
3. Ionic bond
4. Hydrogen bond

III. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Determine the length, polarity and polarizability of the bond: C2H2, C2H4, C6H6, C3H4, C3H8, C3H6, C2H4.

2. Write graphical formulas and determine the number of δ - and π - bonds in the molecules: C2H2, C2H4, C6H6, C3H4, C3H8, C3H6, C2H4.

3. Define the type of chemical bond.



- recommendations (instructions) for performing tasks orienting maps for the

formation of practical skills

No p.p.	Main tasks	Instructions	Answers
1	2	3	4
1	Covalent bond.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - p. 13
2	Donor-acceptor bond.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - p. 14
3	Ionic bond	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008 p. 14

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

IV. Summing up

As a result of the class, students are introduced to the types of chemical bonds.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1. www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
1 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
2 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
3 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson No. 3

Topic: Mutual influence of atoms in organic compounds.

Goal:familiarize yourself withmutual influence of atoms in organic compounds.

Basic concepts: Inductive effect. Conjugate systems. Mesomeric effect.

Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of background knowledge: a frontal survey.
   The student should know the requirements for students' theoretical readiness to perform practical classes:
   - electron-donor and electron-acceptor substituents;
   - inductive and mesomeric effects;
   - types of coupled systems;
   - types of hybridization of atomic orbitals of carbon, nitrogen, oxygen.

the student should be able to:

- to determinecombined influence of inductive and mesomeric effects
- to installelectron-donating and electron-accepting substituents.
-determinemethods of imaging the distribution of electron density in molecules

List of didactic units:

- textbook text
- a bank of test tasks.

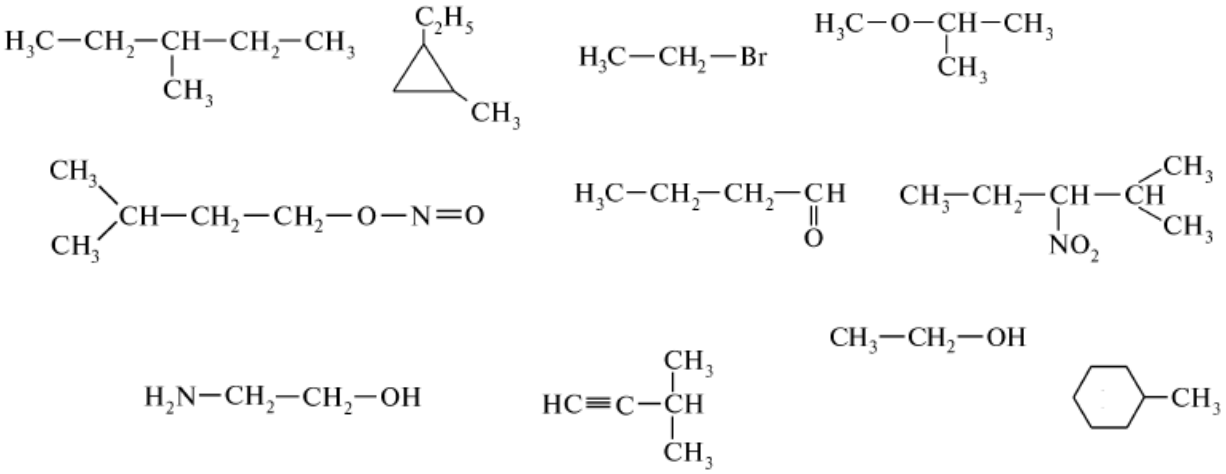
Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Inductive effect.
2. Mesomeric effect.

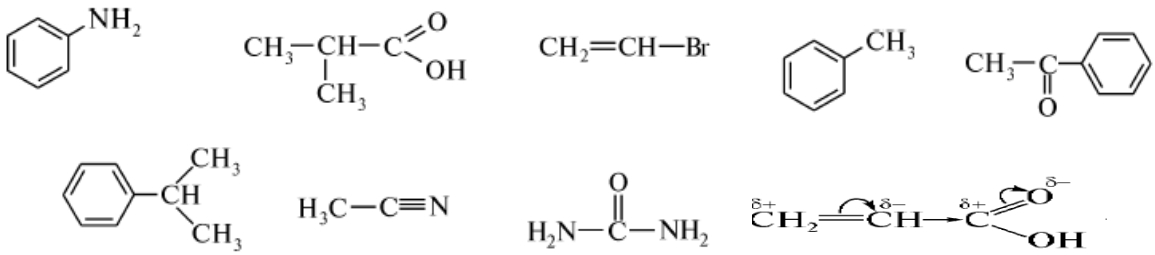
3.Electron-donor and electron-acceptor substituents

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
- task content:

1. Specify the type of substitute and the direction of action of the inductive effect.



2. Specify the type of mesomeric effect and its direction.



- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No p.p.	Main tasks	Instructions	Answers
1	2	3	4
1	Inductive effect.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. pp. 20-24

2	Mesomeric effect.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - pp. 20-24
3	Electron-donor and electron-acceptor substituents	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - pp. 20-24

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

IV. Summing up

As a result of the class, the students are introduced tomutual influence of atoms in organic compounds.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. -

Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson No. 4

Topic: Isomerism of organic compounds. Acidic and basic properties of organic compounds.
Goal:get acquainted with isomerism of organic compounds, acidic and basic properties of organic compounds.
Basic concepts: Structural. Stereoisomers. Optical isomerism. Chirality. Asymmetric carbon atom. Geometric isomerism. Cis-trans isomerism.

Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
The student should know the requirements for students' theoretical readiness to perform practical classes:

- types of isomerism of organic compounds.

- the possibility of formation of isomers of different types.
- types of reaction mechanisms

the student should be able to:

- to determine the reaction mechanism for use in studying the properties of organic substances.
- establishisomerism
- determine organic acids and bases.

List of didactic units:

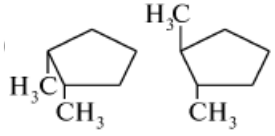
- textbook text
- a bank of test tasks.

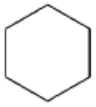
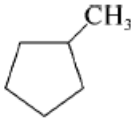
Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

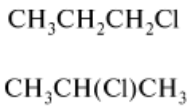
1. Spatial structure of molecules (configuration, conformation). Ways of depicting the spatial structure of molecules.
2. Structural isomerism (carbon chain isomerism, positional isomerism, functional group isomerism).
3. Stereoisomerism (conformational, configurational).
   - Configurational isomerism (optical, geometric).
   - Conformational (rotational) isomerism.

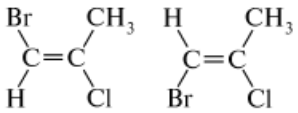
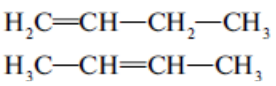
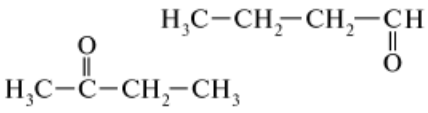
3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Determine the isomers among the formulas: CH3—CaC–CH2–CH2–CH3, C6H12, C6H6, C5H11C(O)H, C3H7(C=O)C2H5, CH3—CH=CH–C3H7, C2H5OC3H7, C5H11COOH, C5H11NH2, C6H10 ,CH3—(CH2)4–CH3, CH3–CH=CH–CH=CH–CH3, C6H14, C5H11OH.
2. Define the type of isomerism:





- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No p.p.	Main tasks	Instructions	Answers
1	**2**	**3**	**4**
1	Structural isomerism.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. pp. 28-33
2	Geometric isomerism.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. pp. 28-33
3	Organic acids and bases.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of

			the NfaU; Original, 2008. pp. 28-33

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the lesson, students are familiar with the isomerism of organic compounds, acidic and basic properties of organic compounds.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic

Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.

4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson No. 5

Topic: Classification of organic reactions and reagents. Methods of determining the structure of organic compounds
Goal:familiarize yourself with the classification of organic reactions and reagents.
Basic concepts: carbcations, carbanions, free radicals, electrophiles, nucleophiles.

Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
The student should know the requirements for students' theoretical readiness to perform practical classes:

- how can C and H be determined;
- methods of determining N and S;
- methods of determining halogens;
- classification of organic reactions.

the student should be able to:

- carry out qualitative elemental analysis of organic compounds.
- interpret the principles of instrumental methods of determining the structure of organic compounds

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Types of reaction mechanisms.

2. Types of organic reactions.

3. Intermediate active particles.

III. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Determination of the specific rotation of optically active substances.

2. Optically active substances of the D and L series.

3. Qualitative reactions to aldehydes.

4. Qualitative reactions to phenols and unsaturated compounds.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No p.p.	**Main tasks**	**Instructions**	**Answers**
1	**2**	**3**	**4**
1	Refractometry.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. pp. 34-38
2	Spectroscopy.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original,

			2008. p. 34-38
3	Infrared spectroscopy.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 34-38

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, students are familiar with the classification of organic reactions and reagents.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson No. 6

Topic: Control testing on topics 1-5
Goal:consolidation of knowledge on classification, nomenclature, isomerism of organic compounds, types of chemical bonds and mutual influence of atoms in organic compounds, electronic effects of substituents.
Basic concepts: Functional groups, classes of organic compounds, nomenclature systems,types of isomerism,iselectronic effects of substituents.

Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: written work, written test, frontal survey, etc.:
The student should know the requirements for students' theoretical readiness to perform practical classes:

- basic provisions of the theory of the structure of organic compounds by O.M. Butlerov;
- rules of different nomenclature;
- features of IUPAC rules;
- classification of organic reactions

the student should be able to:

- to be able to determine the composition of chemical compounds.
- to be able to establish the structure of chemical compounds.
- apply the rules of the systematic nomenclature
- carry out qualitative elemental analysis of organic compounds.
- interpret the principles of instrumental methods of determining the structure of organic compounds

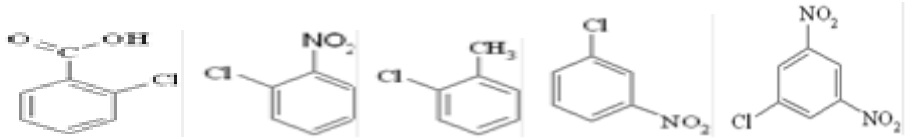
List of didactic units:

- textbook text
- a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1

Formula of 2-nitrochlorobenzene.



A V S D E

2

Organic substances are divided according to the structure of the carbon skeleton into:

ANDAcyclic and cyclic

INAromatic and carbocyclic

WITHHeterocycles and oxygen-containing

DArenes and alkenes

ISAlkanes and cycloalkanes

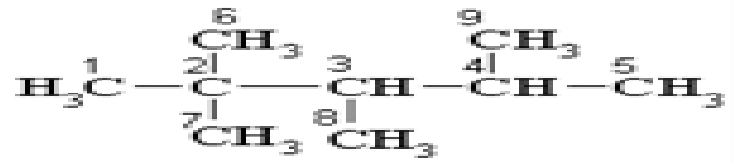
3

Choose a cyclic compound related to carbocycles?

ANDFuran B Tetrahydrofuran C Pyridine D Benzene E Hexane

4

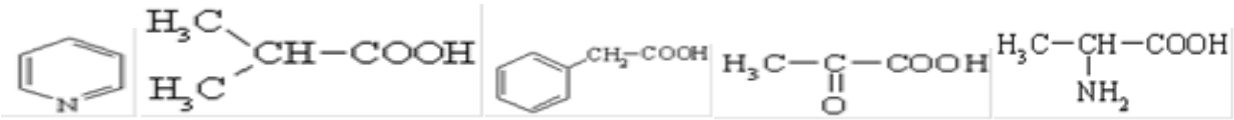
Name the tertiary carbon atoms:



AND2,3,4 V 4 C 2,5 D 3,4 E 1,5

5

Determine which of the following acids contains an asymmetric carbon atom and has optical activity?



A V S D E

6

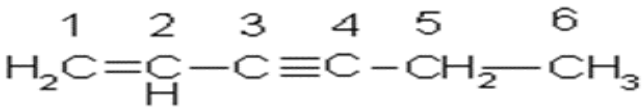
IUPAC replacement nomenclature name:

AND1-propanol. In 2-propanol. C 1,2,3-propanetriol.

D1-propanethiol. E 1,2-propanediol.

7

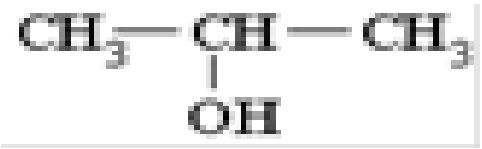
Carbon atoms in the second valence state (sp2-hybridization)



AND1 and 3 B 1 and 2 C 2 and 3 D 3 and 4 E 5 and 6

8

The name of the connection according to the IURAS nomenclature?

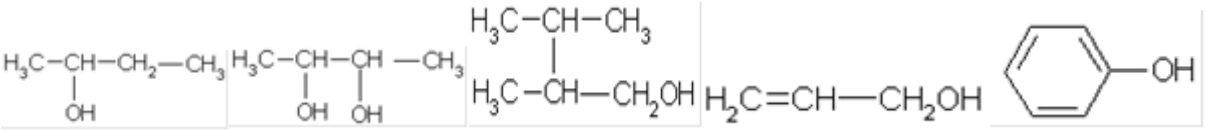


ANDPropanol-2 B Secondary propyl alcohol C Isopropyl alcohol

DDimethylcarbinol E 1-Methylethanol

9

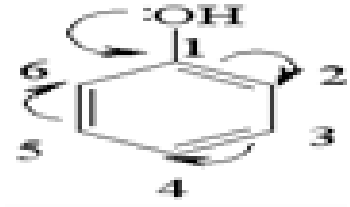
Primary saturated monohydric alcohol?



A V S D E

10

The positions to which the OH group directs the substituents in the phenol molecule in SE reactions?



AND3.5 V 2,4,6 C 3 D 1,2,4,6 E 3,2,1

recommendations (instructions) for performing tasks orienting maps for the formation of practical skills

No p.p.	Main tasks	Instructions	Answers
1	2	3	4
1	Functional group	Characteristics of the specified	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko

		concepts	I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. - p. 11
2	Geometric isomerism.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. pp. 28-33
3	Organic acids and bases.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. pp. 28-33

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the lesson, students consolidated their knowledge of classification, nomenclature, isomerism of organic compounds, types of chemical bonds and mutual influence of atoms in organic compounds, electronic effects of substituents.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua – a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson No. 7

Topic: Alkanes.

Goal:get acquainted with the chemical properties of alkanes.

Basic concepts: Homologous series. Nomenclature. Isomerism. Mining methods. Natural sources of hydrocarbons. Physical properties. Chemical properties.
Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- obtaining alkanes;
- basic chemical properties of alkanes;
- application of the basic rules of various nomenclatures.
- homologous series of methane,

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;
- to identify substances of this class of compounds

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, nomenclature, isomerism of alkanes, homologous series and homologous difference.

2. Conformation of alkanes.

3. Methods of extracting alkanes.

4. Radical substitution reactions (Sr) in a number of alkanes. Mechanisms of halogenation, nitration, sulfochlorination.

5. Oxidation of alkanes.

6. Cracking and reforming of alkanes.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. What kind of flame do alkanes burn? Their practical use.

2. Write reaction equations with the help of which the following transformations can be carried out: a) Al4C3→butane; b) ethane→2,3 - dimethylbutane.

3. With which of the following compounds does butane react: a) conc. H2SO4, (20 0C); b) HNO3 solution (140 0C); c) Br2 in the dark and in the light.

4. Methods of identification of alkanes, cycloalkanes.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Halogenation.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 38-46
2.	Nitration.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: Original, 2008. p. 38-46

3.	Sulfochlorination.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: Original, 2008. p. 38-46

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners were introduced to the chemical properties of alkanes.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson No. 8

Topic: Cycloalkanes.

Goal:get acquainted with the chemical properties of cycloalkanes.

Basic concepts:had cycles, large cycles, conformation.
Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
The student should know the requirements for students' theoretical readiness to perform practical classes:

- homologous series m,
- obtaining cycloalkanes;
- basic chemical properties of cycloalkanes;
- application of the basic rules of various nomenclatures.

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;
- to identify substances of this class of compounds

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, nomenclature, isomerism of cycloalkanes, homologous series and homologous difference.

2. Conformation of cycloalkanes.

3. Methods of producing cycloalkanes.

4. Mechanisms of halogenation, nitration, sulfochlorination.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Isomerism of cycloalkanes. Different shapes of molecules.

2. Find the formula of a hydrocarbon whose hydrogen density is 28.

3. Give the name and write the formulas of its isomers.

4. Polycyclic systems: prismane, cubane, adamantane.

5. Methods of identification of cycloalkanes.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Small cycles.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of

			the NfaU; Original, 2008. p. 40-47
2.	Equatorial connections.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: Original, 2008. p. 40-47
3.	Bicyclic cycloalkanes.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: Original, 2008. p. 40-47

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners were introduced to the chemical properties of cycloalkanes.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
1Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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Practical lesson 9.

Topic: Alkenes, alkadienes.

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Alkenes. Alkadienes. Homologous series. Nomenclature. Isomerism. Markovnikov's rule. Diene synthesis.
Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;

- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure and nomenclature of alkenes.
2. Structural and cis-trans isomerism.
3 Methods of extraction of alkenes.
4. Reactions of electrophilic addition (AB).
5. Markovnikov's rule and its electronic interpretation.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Types of isomerism of alkenes. Cis- and trans-isomers, E and Z systems.
2. Polymerization reactions. Monomer. Polymer. Monomer link.
3. Polyethylene, its production and properties.
4. Teflon, its properties and use in surgery.
5. Application of polymeric materials in pharmacy.
6. Application of ethene in industry and agriculture.
7. What happens to the KMnO4 solution when ethene is passed through it?
8. How does the degree of oxidation of manganese change in this case?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Polyethylene.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 50-58
2.	Diene synthesis.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: Original, 2008. p. 50-58
3.	Rubber.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: Original, 2008. p. 50-58

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 10.

Topic: Alkynes.

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Alkynes. Homologous series. Nomenclature. Isomerism. Acetylene. Kucherov's reaction.
Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. The structure of the triple bond, the type of hybridization.
2. Physical properties of acetylene.
3. Complete and incomplete oxidation of acetylene.
4. Acetylene identification reaction.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Write a reaction scheme for the production of 2-butyne from propyne through organomagnesium compounds.

2. What effect does acetylene have on the body?

3. Industrial methods of obtaining acetylene, its use.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Kucherov's reaction.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 56-60
2.	Dimerization.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 56-60
3.	Cyclotrimerization.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic

			chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 56-60

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in

the field of biomedical sciences.

2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 11.

Topic: Identification of unsaturated hydrocarbons.

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Alkynes. Homologous series. Nomenclature. Isomerism. Acetylene. Kucherov's reaction.
Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text

- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. The structure of the triple bond, the type of hybridization.

2. Physical properties of acetylene.

3. Complete and incomplete oxidation of acetylene.

4. Acetylene identification reaction.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Write a reaction scheme for the production of 2-butyne from propyne through organomagnesium compounds.

2. What effect does acetylene have on the body?

3. Industrial methods of obtaining acetylene, its use.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Kucherov's reaction.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 56-60
2.	Dimerization.	Characteristics of the specified	Chernykh V.P., Zimenkovskyi

		concepts	B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 56-60
3.	Cyclotrimerization.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 56-60

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.

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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1. www.ncbi.nlm.nih.gov/PubMed – free access to the scientific database in the field of biomedical sciences.
2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua – a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 12.

Topic: Mononuclear arenas. Nomenclature. Synthesis.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Mononuclear arenas. Hückel's rule. Homologous series. Nomenclature. Isomerism. Aromatic properties.
Equipment:visual material, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;

- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Classification of cyclic compounds. Arenas.
2. Aromaticity of compounds. Hückel's rule.
3. The structure of the benzene molecule, its properties.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Laboratory method of obtaining benzene? Conditions and type of reaction.

2. Arrange these compounds in order of increasing reactivity in electrophilic substitution reactions: C6H5OH, C6H5Cl, C6H5H2, C6H5COOH.

3. Landmarks of the 1st kind. Examples.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**

1.	Hückel's rule.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
2.	Criteria of aromaticity.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
3.	Trimerization.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 13.

Topic: Mononuclear arenas. Physico-chemical properties.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Mononuclear arenas. Hückel's rule. Homologous series. Nomenclature. Isomerism. Aromatic properties.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Homologs of benzene, their properties.
2. Mechanisms of halogenation, sulfonation, and nitration reactions.
3. Addition and oxidation reactions.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Landmarks of the II-kind. Examples.

2. Why is toluene chemically more active than benzene?

3. Using reaction equations, explain the chemical properties of ethylbenzene
- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Hückel's rule.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
2.	Criteria of aromaticity.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
3.	Trimerization.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.

4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 14.

Topic: Polynuclear arenas with condensed cycles.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Naphthalene. Anthracene. Phenatrene. Homologous series. Nomenclature. Isomerism. Aromatic properties.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Classification, nomenclature and isomerism of polynuclear compounds.

2. Polynuclear compounds with condensed nuclei, their numbering, aromaticity.

3. Naphthalene, its properties, production, application.

4. Naphthalene derivatives. Naphthols. Their application.

5. Other polynuclear compounds: anthracene, phenanthrene, structure of their molecules.

6. Oxidation and substitution reactions, their mechanism.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. What is naphthalene soluble in, how can it be cleaned from foreign impurities?

2. How many mono- and disubstituted isomers are there in naphthalene?

3. How is naphthalene similar and different from benzene in terms of its structure and properties?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Naphthalene.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
2.	Phenatrene.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic

			chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
3.	Anthracene.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.

8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 15.

Topic: Multinuclear arenes with isolated cycles.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Biphenyl. Triphenylmethane. Homologous series. Nomenclature. Isomerism. Aromatic properties.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Classification, nomenclature and isomerism of polynuclear compounds.

2. Polynuclear compounds with isolated nuclei, their numbering, aromaticity.

3. Biphenyl, its properties, production, application.

4. Derivatives of triphenylmethane. Their application.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Alizarin and triphenylmethane dyes, their use.

2. Diamond green, its use in medicine.

3. Phenolphthalein as an indicator and medicine (purgen).

4. Write schemes for extracting active particles of the triphenylmethane series and explain the reason for their stability?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Biphenyl.	Characteristics of the specified	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko

		concepts	I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
2.	Triphenylmethane.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
3.	Phenolphthalein	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.

2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 16.

Topic: Control testing on topics 7-12.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Carbohydrates Homologous series. Nomenclature. Isomerism. Aromatic properties.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

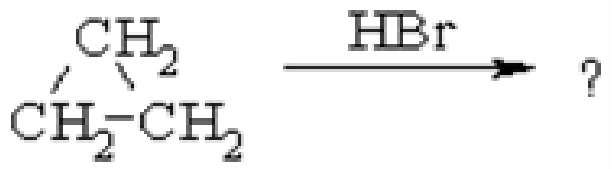
List of didactic units:

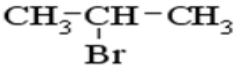
- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1

The interaction of cyclopropane with hydrogen bromide forms



AND 

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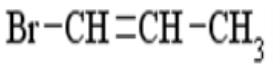
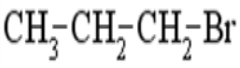


with



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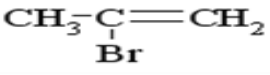
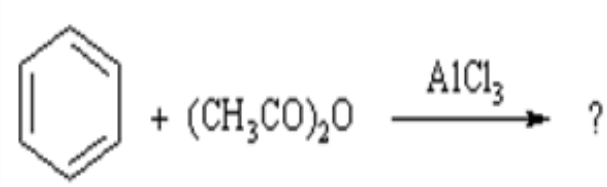
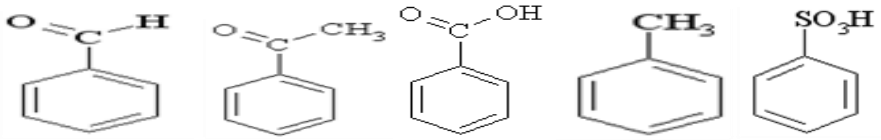


IS

2

Benzene acylation product

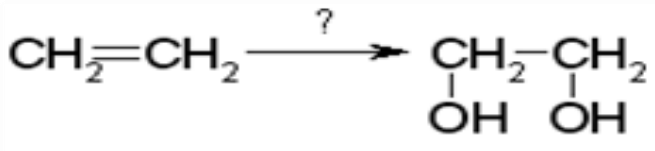




A V S D E

3

The reactant in the reaction?

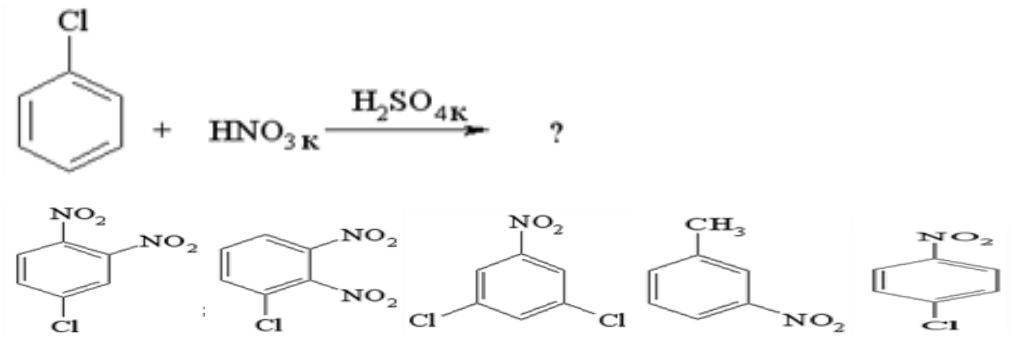


ANDK2Cr2O7 + H2SO4 In NaOH + I2 With CO + H2O

DKMnO4 (H2O) E KOH + MnO2

4

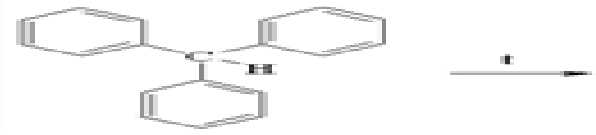
Nitration product of chlorobenzene.



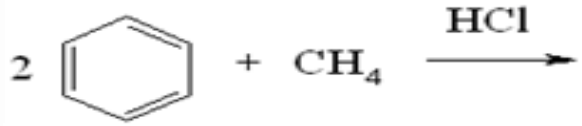
A V S D E

5

The reaction of obtaining diphenylmethane?



AND



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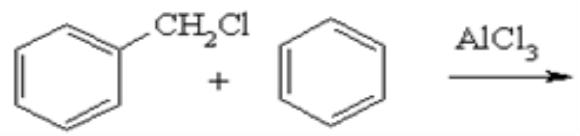

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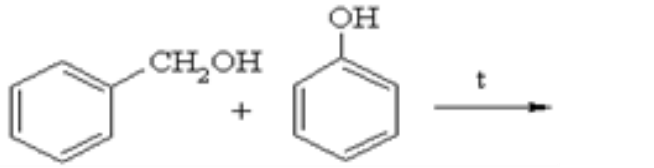

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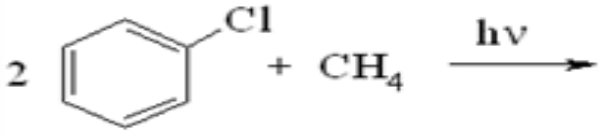


IS

6

The reaction product of metallic sodium and 1-chloropropane:

ANDCyclobutane B Pentane C 2-methylpentane D Cyclohexane E Hexane

7

The reaction of obtaining ethyl alcohol:

AND 

IN 

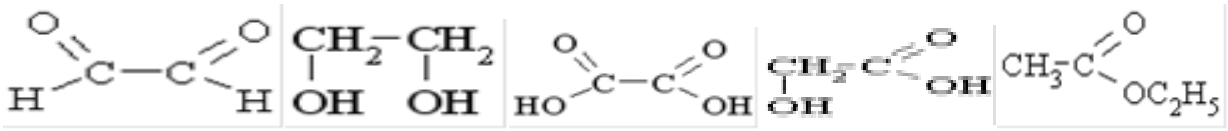
WITH 

D 

IS 

8

What is formed in the reaction of oxidation of acetylene with potassium permanganate in a neutral medium:



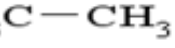
A V S D E

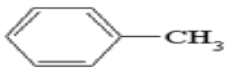
9

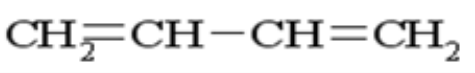
Find which of the following compounds shows the most pronounced CH-acidic properties:

ANDH2C = CH2

INHC ≡ CH

WITH 

D 

IS 

10

Name the product of bromination of benzene.

A V S D E

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Alkenes, alkadienes.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
2.	Mononuclear arenas	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh -

			Kharkiv.: View of the NfaU; Original, 2008. p. 69-70
3.	Hungry	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 69-70

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1. www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 17.

Topic: Haloalkanes. Haloalkenes.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Haloalkanes. Haloalkenes. Homologous series. Nomenclature. Isomerism. Zaitsev's rule
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;

- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Elimination reactions of halogen derivatives.

2. Halogen derivatives of saturated and unsaturated hydrocarbons.

3. Halogen derivatives of aromatic hydrocarbons with halogen in the core and in the side chain.

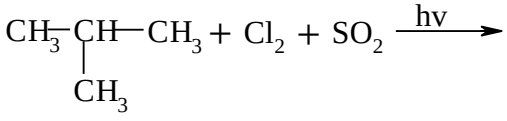
4. Halogen derivatives as drugs, methods of their identification.

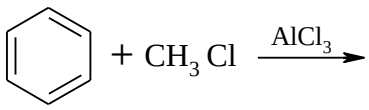
5. Alkyl, vinyl halogen derivatives, their properties.

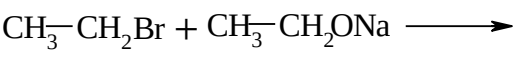
6. Methods of identification of halogen derivatives.

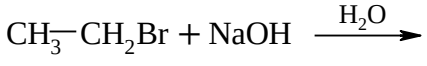
3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Genetic relationship between hydrocarbons and their halogen derivatives and other classes of organic compounds.
2. Complete the chemical reaction equation:

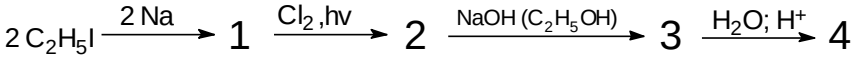








3. Perform the conversion. Name all compounds in the transformation chain.



- recommendations (instructions) for performing tasks orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Zaitsev's rule.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 82-89
2.	Nucleophilic substitution.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 82-89
3.	Malachite green.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 82-89

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.

4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 18.

Topic: Halogenarenes and arylalkyl halides.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Halogenarenes. Arylalkyl halides. Homologous series. Nomenclature. Isomerism.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Elimination reactions of haloarenes and arylalkyl halides.

2. Halogen derivatives of aromatic hydrocarbons with halogen in the core and in the side chain.

3. Halogenarenes and arylalkyl halides as drugs, methods of their identification.

4. Identification methods.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Names of the above compounds according to the substitute nomenclature of IURAS:

a) 7-amino-9-methyl-1-chlorophenanthrene

b) 2,4,6-trinitrotoluene

c) 2,3,3,5-tetramethyl-4-ethylhexane

d) methyl cyclopropane

f) acetophenone.

2. Complete the chemical reactions:

$C_6H_5–Cl + NaOH =$

$C_6H_5–OH + NaCl.=$

$C_6H_5–Cl + 2NH_3 =$

$C_6H_5–NH_2 + NH_4Cl.=$

3. Specify the type of reaction and products

$C_6H_5–Cl + HNO_3 \rightarrow$

$C_6H_5–Cl + H_2SO_4 \rightarrow$

- recommendations (instructions) for performing tasks orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Zaitsev's rule.	Characteristics of the specified	Chernykh V.P., Zimenkovskyi

		concepts	B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 82-89
2.	Nucleophilic substitution.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 82-89
3.	Malachite green.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 82-89

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.

2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
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Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 19.

Topic: Nitro compounds. Methods of nitration of organic compounds.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Nitro compounds. Nitroalkanes. Nitroarenes. Homologous series. Nomenclature. Isomerism.
Equipment:laptop, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. General characteristics of nitro compounds.
2. Isomerism and nomenclature of nitro compounds x.
3. Physical and chemical properties.
4. Methods of obtaining.
5. Nitro compounds as drugs, methods of their identification.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Structure, isomerism, nomenclature of nitro compounds of the aliphatic series.

2. Mono and poly nitro compounds, their preparation and properties.

3. Nitro compounds of the aromatic series, their properties.

4. Properties of nitroso compounds, their isomerism, nomenclature, properties and preparation.

5. Individual representatives of nitrogenous compounds as drugs (acetanilide, phenatidine, streptocid, etazol, paracetamol, chloramphenicol) and their use as drugs.

6. Methods of identification of nitro compounds.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Nitroalkanes.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 91-95
2.	Nitroarenes.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 91-95
3.	Nucleophilic substitution.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic

			chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 91-95

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up
As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 20.

Topic: Aliphatic amines.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Amen. Schiff's Basics. Isonitrile reaction. Homologous series. Nomenclature. Isomerism.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Aliphatic amines, their chemical properties, and production.
2. Chemical and physical-chemical methods of identification of amines.
3. Individual representatives of nitrogenous compounds as drugs (acetanilide, phenatidine, streptocid, etazol, paracetamol, levomycetin) and their use as drugs.
3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Zinin's reaction, its meaning.
2. Primary, secondary and tertiary nitro compounds.
3. Nitrobenzene as a solvent.
4. Synthesis of streptocide. Its application.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Basicity.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 105-112
2.	Alkylation.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko

			I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 105-112
3.	Acylation.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 105-112

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.

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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 21.

Topic: Aromatic amines. Diamines.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Methylamine, dimethylamine, trimethylamine, aniline, toluidines, phenamine.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;

- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature.

2. Aromatic amines. Aniline, its properties, extraction. Zinin's reaction.

3. Chemical and physical-chemical methods of identification of amines.

4. Individual representatives of nitrogenous compounds as drugs (acetanilide, phenatidine, streptocid, etazol, paracetamol, chloramphenicol) and their use as drugs.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Zinin's reaction, its meaning.

2. Identification of primary, secondary and tertiary amines.

3. Synthesis of streptocide. Its application.

4. Sulfanilic acid and its derivatives as medicines.

5. Specify the features of the reactivity of diamines.

6. Arrange in descending order the main properties of amines: methylamine, diethylamine, aniline, p-nitroaniline.

7. To propose a method of obtaining p-nitroaniline from benzene.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Sulfanilic acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 110-116
2.	Streptocide.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 110-116
3.	ANDnilin	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 110-116

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on

bioorganic and medicinal chemistry.

Practical lesson 22.

Topic: Identification of aliphatic and aromatic amines.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Amen. Schiff's Basics. Isonitrile reaction. Homologous series. Nomenclature. Isomerism.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Aliphatic amines, their chemical properties, and production.
2. Chemical and physical-chemical methods of identification of amines.
3. Individual representatives of nitrogenous compounds as drugs (acetanilide, phenatidine, streptocid, etazol, paracetamol, levomycetin) and their use as drugs.
3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Zinin's reaction, its meaning.

2. Primary, secondary and tertiary nitro compounds.

3. Nitrobenzene as a solvent.

4. Synthesis of streptocide. Its application.
- formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Basicity.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 105-112
2.	Alkylation.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 105-112

3.	Acylation.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 105-112

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.

2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 23.

Topic: Diazo compounds. Methods of diazotization.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Azo coupling reaction. Dianitrogenation.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature.

2.Diazo compoundsproperties, mining.

3. Chemical and physical-chemical methods of identification.

4. Individual representatives of nitrogenous compounds and their use as medicines.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1.Classification, nomenclature, diazotization reaction, its conditions, mechanism. Structure of diazonium salts.

2.Reactions of diazonium salts without nitrogen release, azo-compound reaction. Physical foundations of color theory.

3.Formation of diazonium salts.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Diazo compounds.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136

2.	Methods of diazotization.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136
3.	Diazotization reaction	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. -

Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 24.

Topic: Azo compounds. Azo coupling reactions.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Azo coupling reaction. Azo compounds.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;

- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature.

2.Azo compoundsproperties, mining.

3. Chemical and physical-chemical methods of identification.

4. Individual representatives of nitrogenous compounds and their use as medicines.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1.Classification, nomenclature, azo compound.

2. Azo-compound reactions, conditions of conduct.

3.Azo coupling reactions, mechanism and directions.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**

1.	2	3	4
1.	Azo compounds.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136
2.	Reaction of azo compound.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136
3.	Diazotization reaction	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
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7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 25.

Topic: Azo dyes. Methods of diazotization and azo coupling.
Goal:get acquainted with the chemical properties of substances.

Basic concepts: Azo coupling reaction. Azo dyes.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature.

2.Diazo-, azo compoundsproperties, mining.

3. Chemical and physical-chemical methods of identification.

4. Individual representatives of nitrogenous compounds and their use as medicines.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1.Classification, nomenclature, diazotization reaction, its conditions, mechanism. Structure of diazonium salts.

2.Reactions of diazonium salts without nitrogen release, azo-compound reaction. Physical foundations of color theory.

3.Concept of chromophores and auxochromes. Azo dyes (methyl orange, methyl red), indicator properties.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Phenolphthalein	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136
2.	Reaction of azo compound.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136
3.	Diazotization reaction	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P.

			Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 124-136

- requirements for work results, including to registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1. www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.

2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 26.

.

Topic: Monohydric alcohols and dihydric alcohols.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Eltekov's rule. Glycerin. Ethylene glycol.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature of monoatomic alcohols.
2. Homologous series of monoatomic alcohols, formation of associates.
3. Chemical properties of alcohols, intermolecular and intramolecular dehydration.
4. Unsaturated alcohols and their properties. Eltekov's rule.
5. Medical drugs analogues of alcohol

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. How does a hydrogen bond affect the physical properties of alcohols?
2. Why does the volume decrease when ethanol is dissolved in water?
3. What is the effect of ethanol on the human body?
4. How to check the purity of medical ether?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Eltekov's rule.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh -

			Kharkiv.: View of the NfaU; Original, 2008. p. 144-156
2.	Ethylene glycol.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156
3.	Ethanol.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 27.

.

Topic: Polyhydric alcohols. Fats
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Glycerin. Esterification.
Equipment:laptop, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes

the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature of polyhydric alcohols.

2. Homologous series of polyhydric alcohols.

3. Chemical properties.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Reaction of etherification.

2. Formation of fats.

3. Favorite reaction.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	Main tasks	Instructions	Answers
1.	2	3	4

1.	Esterification.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156
2.	Glycerin.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156
3.	Esther.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156

- Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 28.

.

Topic: Monoatomic and polyatomic phenols.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Eltekov's rule. Phenol. Resorcin
Equipment:laptop, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature of aromatic alcohols.

2. Homologous series of aromatic alcohols.

3. Chemical properties of phenols, intermolecular and intramolecular dehydration.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. How does hydrogen bonding affect the physical properties of phenols?

2. Solubility of phenol in water.

3. Qualitative reaction to aromatic alcohols.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Phenol.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156
2.	Resorcin	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156
3.	Benzyl alcohol.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 144-156

- Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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Additional:

3 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
4 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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7 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
8 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 29.

.

Topic: Ethers. Thioalcohols and thioethers.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Thio-alcohols (thiols, mercaptans). Thioethers (sulfides). Dimexide.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure, isomerism, nomenclature.

2. Homologous series.

3. Chemical properties.

4. Medical drugs analogues

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Safety techniques when working with ether.

2. Why ethers have a lower boiling point compared to the corresponding alcohols.

3. Write the reaction equation of diethyl ether with HCl; HI; O2; H2SO4(conc).

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Diethyl ether.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 201-206
2.	Thio alcohols.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 201-206
3.	Thioethers.	Characteristics of the specified	Chernykh V.P., Zimenkovskyi

		concepts	B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 201-206

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
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Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 30.

.

Topic: Thematic control work on topics 14-21.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Halogen-, hydroxy and nitrogen-containing compounds.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

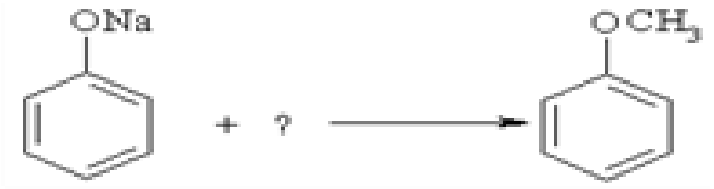
- textbook text

- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1

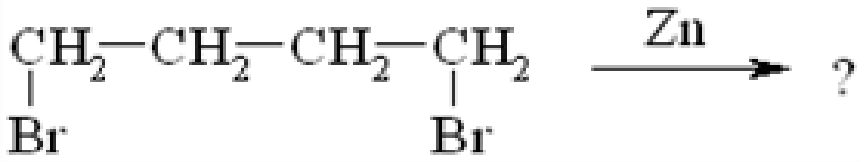
Is the reagent for obtaining phenol ester on sodium phenoxide?

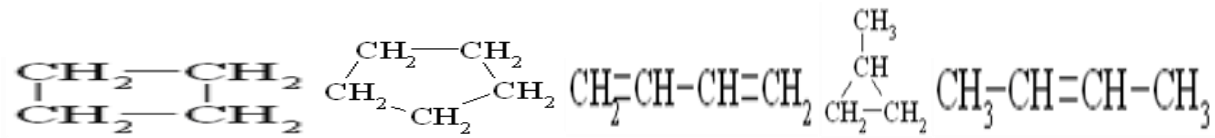


ANDCH3OH B CH4 C H3NH2 Д CH3Cl E CH3C ≡ N

2

1,4-dibromobutane with zinc forms:

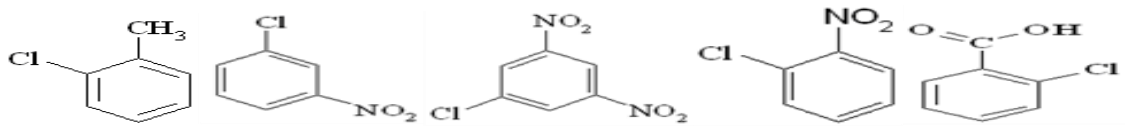




A B C D E

3

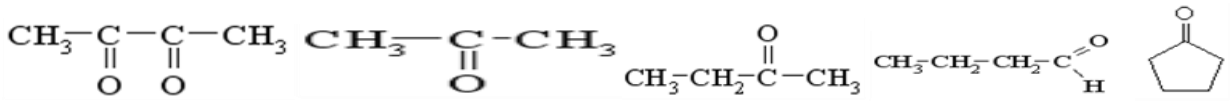
2-nitrochlorobenzene formula?



A B C D E

4

Does the compound form butanol-2 upon reduction?



A B C D E

5

A qualitative reaction to salicylic acid is interaction with:

ANDNaOH B H2SO4 C FeCl3 D CH3COOH E CH3OH (H +)

6

What reagent is used in the nitration reaction of aniline to protect the amino group from oxidation by acylation?

ANDCH3CHO B (CH3CO)2O C C2H5Cl D HNO2 E CHCl3 + NaOH

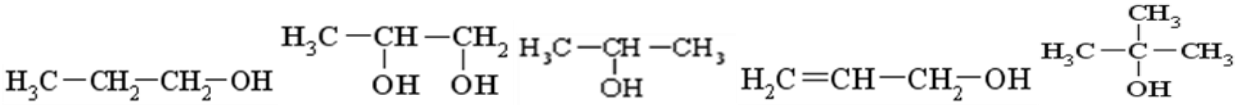
7

What reagent can distinguish glycerin from ethylene glycol?

ANDNaOH In Na met. C Cu (OH) 2 D NaNO2 E KHSO4

8

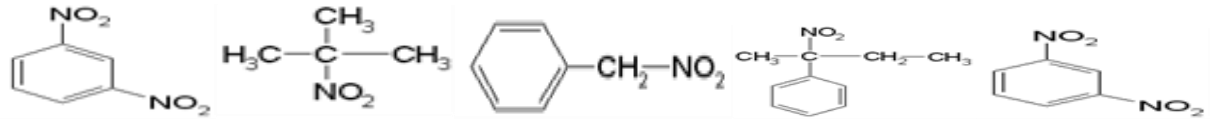
Formula of secondary alcohol:



A B C D E

9

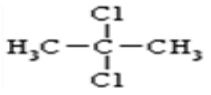
Are nitro compounds able to dissolve in alkali solutions?



A B C D E

10

Name which of the following halogen derivatives will react with an aqueous alkali solution to form an alcohol?

ANDCH3CH2Cl B CH3-CHCl2 C CH3-CCl3 D C6H5Cl E 

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Nitrogen-containing compounds.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 201-206
2.	Hydroxy compounds.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh -

			Kharkiv.: View of the NfaU; Original, 2008. p. 201-206
3.	Thioethers.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 201-206

- requirements for work results, including to registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1. www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 31.

Topic: Aldehydes. Chemical properties. Identification of aldehydes.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Reactions of the "silver mirror". Reaction centers.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;

- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Reactions of electrophilic and nucleophilic addition and substitution.

2. Specific reactions of aldehydes of the aliphatic series.

3. Identification reactions of aldehydes and ketones of the aliphatic series.

4. Characteristics of individual representatives of aldehydes and ketones of the aliphatic series and their derivatives - medical preparations

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. What is the difference in the chemical properties of aldehydes and ketones of the aliphatic series?

2. Write the formulas of pentanal and pentanone isomers. Give names.

3. How is formalin stored? Why?

4. Who first received and established the formula of urotropin?

5. Write the formula of urotropin, give its chemical name.

6. Where did the name "aldehyde" come from? What two words does it consist of?

8. Reactions of "silver mirror" and "copper mirror"?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**

1.	Reaction centers.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 212-225
2.	Reactions of the "silver mirror".	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 212-225
3.	Urotropin.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 212-225

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 32.

Topic: Ketones. Chemical properties. Azomethine dyes.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Oxidation reactions. Reaction centers.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Reactions of electrophilic and nucleophilic addition and substitution.

2. Identification reactions of ketones of the aliphatic series.

3. α-, β-unsaturated cyclic diketones, their properties and preparation.

4. Characteristics of individual representatives of ketones of the aliphatic series and their derivatives - medical preparations

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. What is the difference in the chemical properties of aldehydes and ketones of the aliphatic series?

2. Write the formulas of pentanone isomers. Give names.

3. Why are ketones not subjected to the oxidation reaction?

4. Ozonolysis its features?

5. Write a scheme for obtaining caprolactan from phenol.

6. The substance C7H8O does not give color with FeCl3 solution, does not dissolve in alkalis, and upon oxidation gives benzoic acid. What is the formula of this substance?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Reaction centers.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 212-225
2.	Acetone.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 212-225

3.	Urotropin.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 212-225

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.

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3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 33.

Topic: Monocarboxylic acids. Nomenclature. Synthesis.

Goal:get acquainted with the chemical properties of substances.

Basic concepts:CH-acidity. Reaction centers.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;

- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Homologous series of monobasic carboxylic acids, their nomenclature and isomerism.

2. Classification of acids. Saturated and unsaturated, monobasic and polybasic, aromatic acids.

3. Influence of the nature of the substituents in the radical on the reactivity of acids.

4. Effect of the carboxyl group on the hydrocarbon radical. CH-acidity of the α-carbon atom.

5. Addition to α- and β-unsaturated acids.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. How can formic acid be oxidized?

2. What monobasic carboxylic acids give the "silver mirror" reaction?

3. Qualitative reactions to monobasic carboxylic acids.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Reaction centers.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3

			books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 231-241
2.	Benzoic acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 231-241
3.	CH-acidity.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 231-241

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.

3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
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9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 34.

Topic: Monocarboxylic acids. Physico-chemical properties.

Goal:get acquainted with the chemical properties of substances.

Basic concepts:CH-acidity. Reaction centers.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Benzoic acid, its derivatives and their use.

2. Chemical properties of monobasic acids: formation of salts, ethers, anhydrides, halogen derivatives, halogen anhydrides, amides, nitriles.

3. Chemical and physical methods of identification of monobasic carbonyls

acids

4. Individual representatives, their characteristics and medical and biological significance.

5. Monobasic carboxylic acids and their derivatives as drugs.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):

task content:

1. List the uses of acetic acid.

2. Is the name "formic alcohol" correct, what is its composition and where is it used?

3. What is stearin, where is it used?

4. What is the role of carboxylic acids in the Krebs cycle?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Reaction centers.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 231-241
2.	Benzoic acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 231-241
3.	CH-acidity.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic

			chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 231-241

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up
As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
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4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 35.

Topic: Aliphatic dicarboxylic acids.

Goal:get acquainted with the chemical properties of substances.
Basic concepts:CH-acidity. Reaction centers. Malonov Ether.
Equipment:laptop, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. General characteristics of dicarboxylic acids.
2. Homologous series of saturated dicarboxylic acids.
3. Saturated dicarboxylic acids, their structure, isomerism and nomenclature.
4. Oxalic acid, its salts.
5. Unsaturated dicarboxylic acids. Cis and trans isomers. Maleic and fumaric acids.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. How are dicarboxylic acids different from monocarboxylic acids?

2. Salts of which acids form "stones" in the body?

3. How to prepare a 2N solution of oxalic acid in a volume of 0.5 dm3? Make calculations.

4. What are soluble oxalates?

5. Which vegetables and fruits contain the most oxalic acid.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Malonov Ether.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original,

			2008. p. 242-248
2.	Phthalic acids.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248
3.	Phenolphthalein.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
2 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
3 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 36.

Topic: Synthesis based on malonic ester.

Goal:get acquainted with the chemical properties of substances.
Basic concepts:CH-acidity. Reaction centers. Malonov Ether.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1 Malonic acid, its properties.
2 Obtaining malonic ether.
3. Obtaining carboxylic acids from malonic ether.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Acidic properties of malonic ether.
2. Relation of dicarboxylic acids to heating.
3. Hydrolysis of malonic ether.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Malonov Ether.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko

			I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248
2.	Phthalic acids.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248
3.	Phenolphthalein.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.

2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 37.

Topic: Aromatic dicarboxylic acids.

Goal:get acquainted with the chemical properties of substances.
Basic concepts:CH-acidity. Reaction centers. Malonov Ether.
Equipment:laptop, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. General characteristics of aromatic dicarboxylic acids.
2. Homologous series of aromatic dicarboxylic acids.
3. Aromatic dicarboxylic acids, their structure, isomerism and nomenclature.
4. Phthalic acids.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
task content:

1. Phthalic anhydride.
2. Phenolphthalein, its use as an indicator in volumetric analysis.

3. Phenolphthalein, its pharmacological action and application.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Malonov Ether.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248
2.	Phthalic acids.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248
3.	Phenolphthalein.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 242-248

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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Practical lesson 38.

Topic: Acyl halides. Anhydrides. Esther. Synthesis. Physico-chemical properties.

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Esterification reaction. Saponification of fats. Analytical characteristics.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

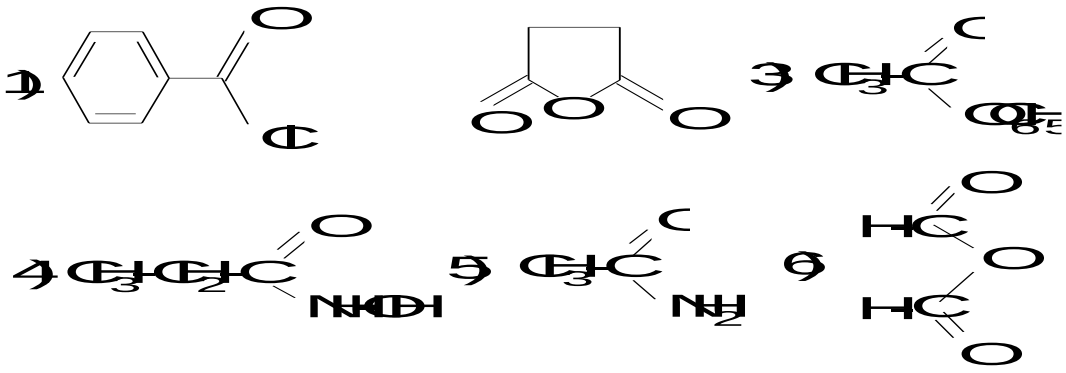
1. Halide anhydrides and anhydrides of carboxylic acids.

2. Complex esters - esters. Esterification reaction, its mechanism.
3. Lipids, their classification and biological significance.
4. Simple lipids. waxes
5. Fats, their composition and properties. Fat oxidation products.
6. Saponification of fats and their hydrolysis. Soap, synthetic detergents (SMZ).
7. Fat hydrogenation. Artificial fats.
8. Analytical characteristics (saponification number, iodine number).
9. Identification of carboxylic acid derivatives.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Task 1. Write the structural formulas of the following compounds: 1) amyl nitrite; 2) ethyl ether of α-bromosovaleric acid; 3) ureide of acetic acid;

*Task 2.*Name the compounds:



*Task 3.*Write the formation reactions:

1) glycerol trinitrate;

2) isopropyl ester of butyric acid, indicating the mechanism by which the reaction takes place;

3) formation of biuret.

- recommendations (instructions) for performing tasks orienting maps for the formation of practical skills

No.p.p.	Main tasks	Instructions	Answers
1.	2	3	4

1.	Halide anhydrides.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 250-263
2.	Ammonolysis.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 250-263
3.	Acetonitrile.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 250-263

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
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Practical lesson 39.

Topic: Amides. Hydrazides Nitriles. Hydroxamic acids. Synthesis. Physico-chemical properties.

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Hydroxam test. Hoffman's rearrangement.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

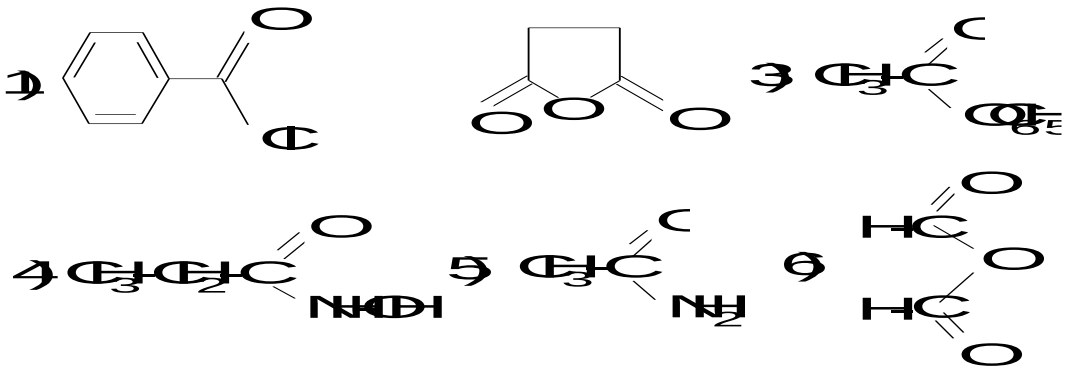
Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Amides nomenclature, production and chemical properties.
2. Hydrazides nomenclature, production and chemical properties.
3. Nitriles nomenclature, production and chemical properties.
4. Hydroxamic acids nomenclature, production and chemical properties.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Task 1. Write the structural formulas of the following compounds: 1) amyl nitrite; 2); 2) ureide of acetic acid; 3) N-ethylacetamide; 4) propanonitrile.

*Task 2.*Name the compounds:



*Task 3.*Write the schemes of hydrolysis reactions of the following compounds: 1) butanoyl chloride; 2) acetic anhydride; 3) benzamide; 4) ethyl formate.

- recommendations (instructions) for performing tasks orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Halide anhydrides.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 250-263
2.	Ammonolysis.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh -

			Kharkiv.: View of the NfaU; Original, 2008. p. 250-263
3.	Acetonitrile.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 250-263

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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Practical lesson 40.

Topic: Halocarbon acids.

Goal:get acquainted with the chemical properties of substances.
Basic concepts: Lactides. Lactones.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;

- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Nomenclature, isomerism and production of halogenated acids.

2. Acidic properties of halogenated acids, their dependence on the number and placement of halogen atoms.

3. Isomerism, nomenclature and preparation of halogenated acids.

4. Chemical properties of halogenated acids.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. What are halocarboxylic acids and what properties do they exhibit?

2. Qualitative reactions to the carboxyl group.

3. Reactions on the halogen atom.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	the Kolbe-Schmidt reaction.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P.

			Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283
2.	n-Aminosalicylic acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283
3.	Sodium salicylate.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 41.

Topic: Hydroxy acids. Phenolic acids

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Kolbe-Schmidt reaction. Lactides. Lactones.
Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Nomenclature, isomerism and extraction of hydroxo- and phenolic acids.

2. Isomerism, nomenclature and production of hydroxo- and phenolic acids.

4. Chemical properties of hydroxy and phenolic acids.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. What are phenolic acids, what properties do they exhibit?

2. Qualitative reaction to salicylic acid.

3. How to prepare a 2N lactic acid solution? Make calculations.

4. Derivatives of salicylic acid as medicine.

5. How to check the benign quality of aspirin?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	the Kolbe-Schmidt reaction.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283
2.	n-Aminosalicylic acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283
3.	Sodium salicylate.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283

- requirements for work results, incl. for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

3 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
4 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

5 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
6 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
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8 www.bioorganica.org.ua is a scientific publication presenting works on

bioorganic and medicinal chemistry.

Practical lesson 42.

Topic: Oxoacids. Dual reactivity.

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Kolbe-Schmidt reaction. Lactides. Lactones.
Equipment:laptop, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Nomenclature, isomerism and extraction.

2. Acid properties, qualitative reactions to the carboxyl group.

3. Isomerism, nomenclature and preparation.

4. Chemical properties of halogen derivatives.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Oxidation reactions.

2. Acetoacetic ether. Extraction, tautomerism, binary reactivity.

3. Acid and ketone cleavage of acetoacetic ether.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Acetoacetic ether.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283
2.	Ketone cleavage	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original,

			2008. p. 271-283
3.	Acid cleavage.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 43.

Topic: Aliphatic and aromatic amino acids.

Goal:get acquainted with the chemical properties of substances.

Basic concepts: Peptide bond. Amphotericity.
Equipment:laptop, multimedia projector

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;

- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Nomenclature, isomerism and extraction.

2. Isomerism, nomenclature and preparation.

3. Chemical properties.

4. Specific reactions to α-, β-, γ-amino acids.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Polycondensation reactions?

2. Qualitative reactions to polypeptides.

3. Qualitative reactions to amino acids.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Peptide bond.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of

			the NfaU; Original, 2008. p. 271-283
2.	Amphotericity.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283
3.	Acidification	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 271-283

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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Practical lesson 44.

Topic: Sulfuric acids. Carbonic acid and its functional derivatives.

Goal:get acquainted with the chemical properties of substances.
Basic concepts: Urea. Phosgene. Carbamic acid.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. General characteristics of carbonic acid, formation of its derivatives.
2. Carbonic acid halogen derivatives, their properties.
3. Phosgene is a complete chloride of carbonic acid.
4. Carbonic acid amides.
5. Carbamic acid and its derivatives.
6. Complete amide of carbonic acid, its preparation and application.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Write the stepwise dissociation of carbonic acid.

3. What acids does this acid belong to?

4. Carbonic acid salts, their names.
5. Carbonic acid chlorides.
6. Carbonic acid amides.
7. Urea is a product of nitrogen metabolism.
8. Use of urea in industry in agriculture.
9. Calculate the pH of a 0.01N solution of carbonic acid.
10. What are ureides and urethanes, their pharmacological action.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Carbonic acid chlorides	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 301-308
2.	Guanidine.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 301-308
3.	Sulfuric acids.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P.

			Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 301-308

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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Practical lesson 45.

Topic: Thematic control work on topics 23-29.

Goal:get acquainted with the chemical properties of substances.
Basic concepts: Oxo compounds. Derivatives of carboxylic acids.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1

Is the reagent with which chloroacetic acid reacts with the participation of a halogen atom?

ANDNaHCO3**IN**BaSO4**C**KCN**D**HCl**IS**SOCl2

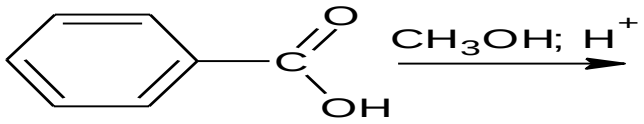
2

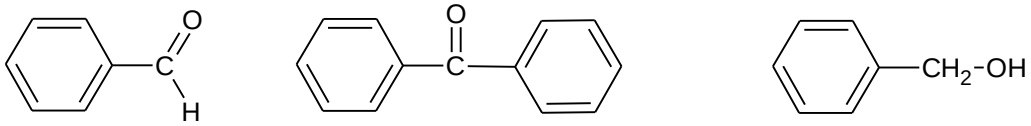
The product of the interaction of ethyl alcohol and formic acid:

ANDHalide anhydrides**IN**Anhydride**C**Amide**D**Nitrile**IS**Ester

3

Reaction product:



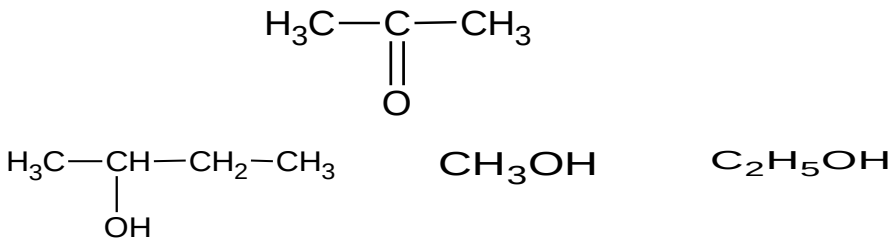


And VWITH

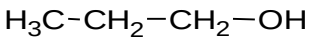
DIS

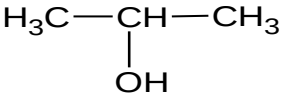
4

Which of the following alcohols forms acetone when oxidized?



And VWITH





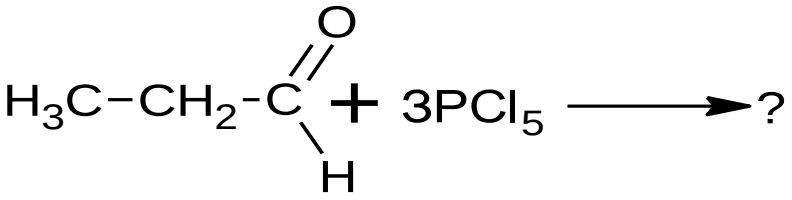
DIS

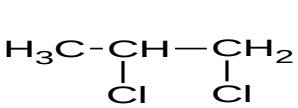
5

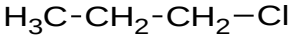
Choose the weakest carboxylic acid according to the pKa value presented:
ANDAcetate (pKa = 4.7)**IN**Ant (RKa = 3.7)**C**Propionova (RKa = 4.9)
DDairy (RKa = 3.9)**IS**Maslyana (RKa = 4.82)

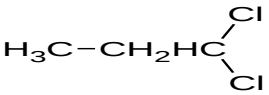
6

The reaction product of propionic aldehyde with PCl5?

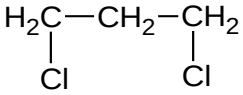


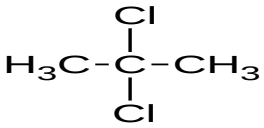






And VWITH





DIS

7

A qualitative reaction confirming the unsaturation of linoleic acid?
CH3(CH2)4CH=CH-CH2-CH=CH(CH2)7COOH

ANDDecolorization of bromine water (Br2; H2O)**IN**Hydrohalogenation (HCl)
CReaction of "Silver mirror" with [Ag(NH3)2]OH
DDecarboxylation**IS**Reaction with FeCl3

8

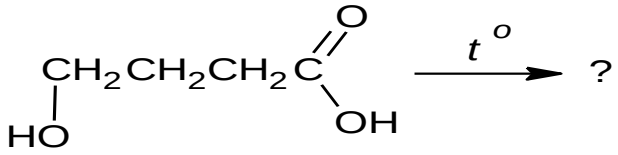
A substance does not contain a carboxyl group, but is called an acid?
ANDValerian acid**IN**Tartaric acid**C**Malic acid
DLactic acid**IS**Picric acid

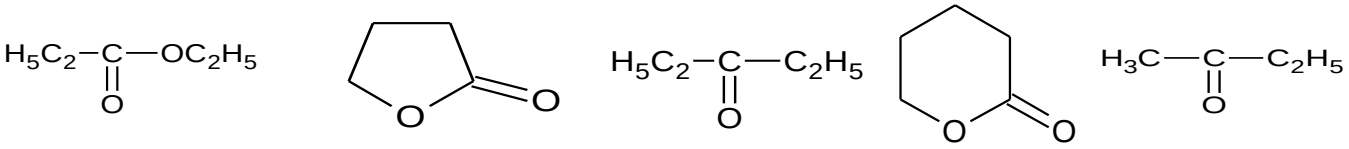
9

Define aromatic dicarboxylic acid?
ANDMaleinova**IN**Phthaleva**C**Malonov**D**Burshtynova**IS**Sorrel

10

γ-butyrolactone is formed when γ-hydroxybutyric acid is heated. Specify it among the following compounds:





A B C D E

. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Homologous series of monobasic carboxylic acids, their nomenclature and isomerism.

2. Carbonic acid salts, their names.

3. How to prepare a 2N lactic acid solution? Make calculations.

4. Derivatives of salicylic acid as medicine.

5. What amino acids are used in the food industry?

6. Phthalic anhydride. Phenolphthalein, its use as an indicator in volumetric analysis.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers

1.	2	3	4
1.	Halide anhydrides.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 243-308
2.	Ammonolysis.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 243-308
3.	Acetonitrile.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 243-308

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

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3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 46.

Topic: General characteristics of heterocyclic compounds. Three- and four-membered heterocycles with one heteroatom.

Goal:get acquainted with the chemical properties of substances.
Basic concepts: Oxirane, aziridine, oxetane, azetidine.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure and biological significance of heterocyclic compounds.

2. Classification of heterocyclic compounds.

3. Nomenclature of heterocyclic compounds, their isomerism.

4. 3-membered heterocycles with one heteroatom.

5. 4-membered heterocycles with one heteroatom.

6. Oxygen heterocycles, their properties.

7. Nitrogen heterocycles. Their structure and properties.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
task content:

1. 3-membered heterocycles, their structure.

2. 4-membered heterocycles, their name.

3. Compare the structure and properties of these heterocycles.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Oxirane	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 312-320
2.	Aziridine.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of

			the NfaU; Original, 2008. p. 312-320
3.	Oxetane.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 312-320

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1.Zymenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 47.

Topic: Five-membered heterocycles. with one heteroatom.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Pyrrole, furan, thiophene. Nomenclature.Acidophobia.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,

- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. General characteristics of 5-membered heterocycles with one heteroatom, numbering and position of carbon atoms.

2. Properties of pyrrole and its derivatives. Their biological significance.

3. Properties of furan and thiophene, their derivatives.

4. Aromaticity of 5-membered heterocycles

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
task content:

1. Why is furfural easily oxidized and gives a "silver mirror" reaction?

2. What is cube painting?

3. Cubic dyes, their use in volumetric analysis.

4. What is indigo soluble in?

5. What color is given by furfural with aniline.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Pyrrol.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic

			chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 343-378
2.	Furan.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 343-378
3.	Thiophene.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 343-378

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.

2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1. Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2. Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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2. https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3. www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4. www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 48.

Topic: Five-membered heterocycles with two heteroatoms.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Imidazole, pyrazole.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. 5-membered heterocycles with two heteroatoms, their structure and properties.

2. Pyrazolone-5, its synthesis and properties.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
task content:

1. Chlorophylls and their role in photosynthesis.

2. Vitamin B-12, its structure and biological role.

3. Indole is a condensed heterocyclic system, its composition and properties.

4. Tryptophan, serotonin, β-indolylacetic acid. Indomethacin.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Imidazole	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 343-378
2.	Pyrazole.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 343-378
3.	Benzimidazole.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original,

			2008. p. 343-378

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.

4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 49.

Topic: Six-membered heterocycles with one heteroatom.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Pyridine.Reactions involving a heteroatom.Electrophilic (SE) and nucleophilic (SN) substitution reactions.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Structure of molecules of 6-membered heterocycles with one heteroatom.

2. Pyridine as an aromatic compound, its properties and extraction.

3. Homologs of pyridine, their structure and properties.

4. How and from what can pyridine be obtained?

5. What are pyridine bases, what is their structure and biological role?

6. What is the difference between pyridine and benzene. Compare the properties of both substances?

7. Pyridine derivatives and their use.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):

task content:

1. What is the difference between pyridine and benzene.

2. Compare the properties of both substances?

3. Picolines, their oxidation.

4. Picolinic acids.

5. Nicotinic acid, its derivatives.

6. Isonicotinic acid derivatives.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Pyridine	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of

			the NfaU; Original, 2008. p. 397-453
2.	Nicotinic acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 397-453
3.	Isonicotinic acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 397-453

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.

4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

1

Practical lesson 50.

Topic: Azines with condensed rings: quinoline, isoquinoline, acridine. Heterocycles of the pyran group.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Quinoline. Acridine. Piranha

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Quinoline and its derivatives.

2. Acridine and its derivatives.

3. Pirans, pyrones, their structure and properties. coumarin, its derivatives.

4. Medico-biological value of drugs based on these heterocycles.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1 How to distinguish between anti- and amidopyrin?
2. Why does analgin have a stronger pharmacological effect than amidopyrine?
3. What effect do pyrazolol-5 derivatives have?

4. Antipyrine synthesis products.
5. Imidazole and its derivatives.
6. Thiazole and its derivatives.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Azole tautomerism.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 453-485
2.	Dibazol.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 453-485
3.	Benzimidazole.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original,

			2008. p. 453-485

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.

4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 51.

Topic: Six-membered heterocycles with two heteroatoms.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Pyrimid. Pyrimidine bases. Barbituric acid.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
The student should know the requirements for students' theoretical readiness to perform practical classes:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Nomenclature and isomerism of azines, their structure.

2. Pyridazine and its derivatives.

3. Pyrimidine bases, their biological role.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Preparation, tautomerism and acidic properties of barbituric acid and its derivatives.
2. Properties of pyrimidine bases (uracil, thymine, cytosine).
3. Tautomeric transformations.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Barbituric acid.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 490-512
2.	Pyrimidine bases	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 490-512

3.	Piperazine.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 490-512

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological

and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 52.

Topic: Seven-membered heterocycles. Condensed systems of heterocycles.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Diazepine, benzodiazepine. Tranquilizers. Purine Azole tautomerism

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,

- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Condensed heterocycles, their composition and molecular structure.
2. Purine is a condensed system, its properties.
3. Uric acid, its derivatives.
4. Piperidine and its derivatives.
5. Folic acid, its biological role.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. What is the biological role of folic acid?
2. Strength and basicity of uric acid.
3. Urates, which metals are deposited in the body?
4. What are urates soluble in?
5. N-methyl derivatives of xanthine.
6. Application of derivatives of seven-membered heterocycles as drugs.
7. Identification of uric acid.
8. Structure of azepines and diazepines.
9. Riboflavin (vitamin B2). Flavoproteins.
10. The essence of the murexide test and its use in pharmaceutical analysis.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**

1.	Lactim-lactamnatautomerism	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 549-612
2.	Folic acid	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 549-612
3.	Riboflavin.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 549-612

- Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.

2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 53.

Topic: Thematic control work on topics 31-36.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Diazepine, benzodiazepine. Tranquilizers. Purine Azole tautomerism

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

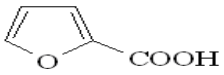
List of didactic units:

- textbook text
- a bank of test tasks.

2.2. Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1

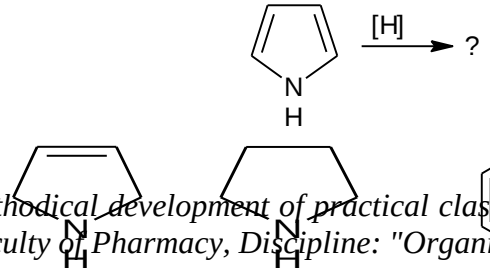
The name of the chemical formula:



ANDhydroxyfuran**IN**furan-2-carboxylic acidWITHfuranose
Dfurfuryl alcohol**IS** furfural

2

When pyrrole is completely reduced, the following is formed:



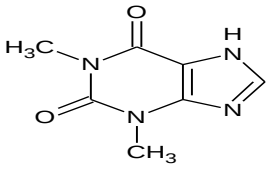
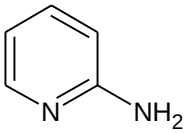
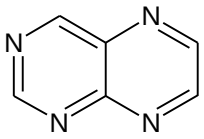
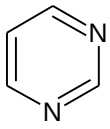
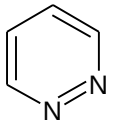
And VS. D. E

3

Detection of uric acid and other compounds containing a purine nucleus is used:
ANDFehling's reagent**IN** The "silver mirror" reaction
WITH The reaction of the "copper mirror"DLucas reagent**IS** Murexide reaction

4

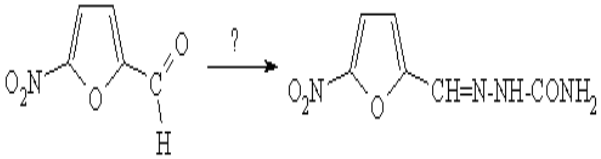
Name the compound containing pyrrole and pyridine nitrogen atoms:

ANDTheophylline**IN**2-aminopyridine**WITH** Pteridine**D**Pyrimidine**IS** Pyridazine

5

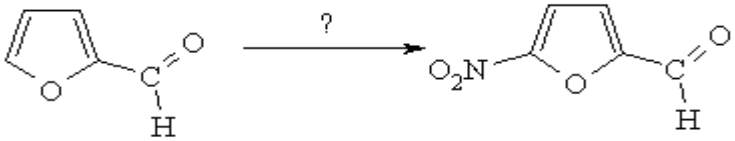
To obtain furacilin, use:



ANDH2N-NH2**IN**H2N-NH-C(S)-NH2WITHH2N-NH-C(O)-NH2
DH2N-OH**IS** H2N-C6H5

6

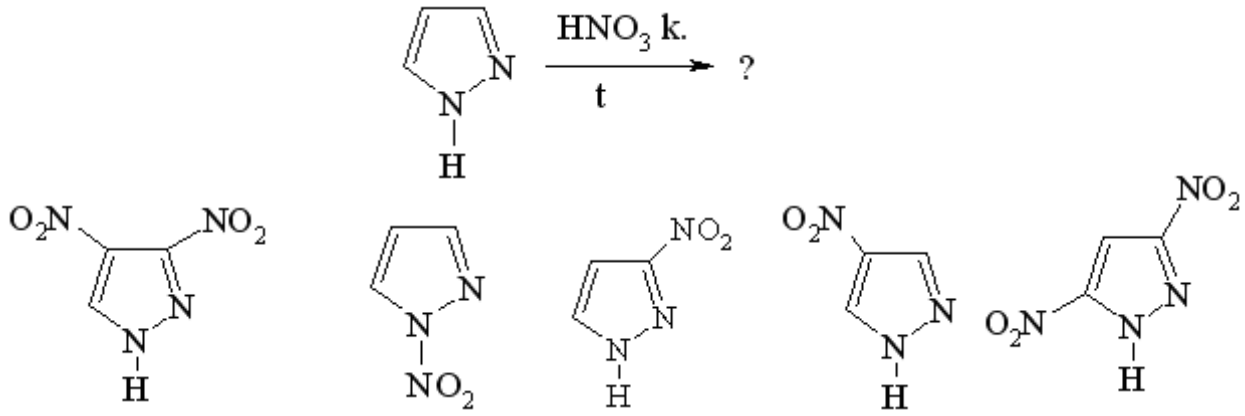
As a nitrating reagent for nitrating furfural, the following is used:



ANDHNO3 (dissolved)**IN** HNO2**WITH** KNO3
Dk. HNO3 + k. H2SO4**IS**k. HNO3+(CH3CO)2O

7

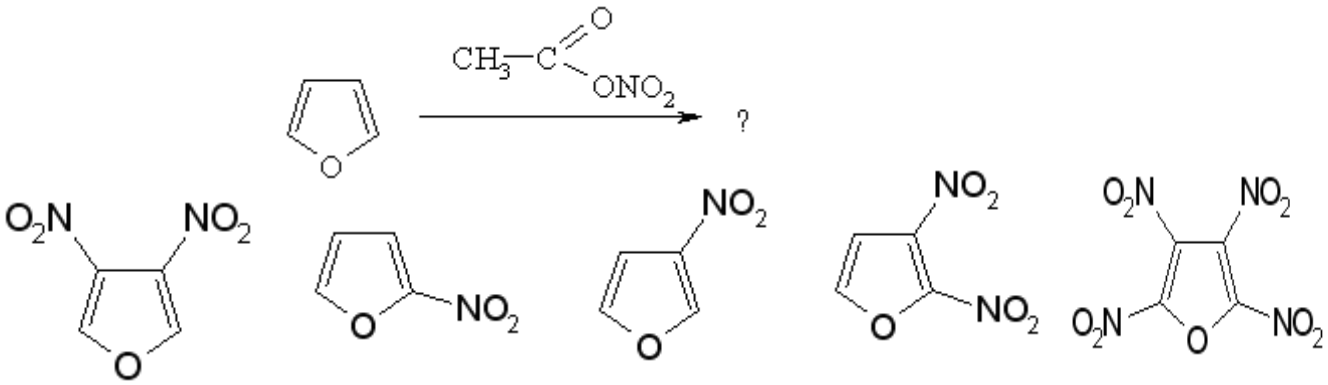
The reaction product of pyrazole with conc. nitric acid when heated



And VS. D. E

8

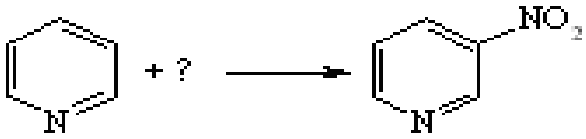
Nitration of furan with acetyl nitrate produces:



And in SD. E

9

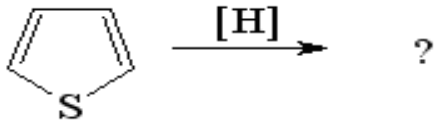
Reagents and conditions used during nitration of pyridine:



ANDKNO3 + H2SO4, t = 300Oc**IN** HNO2**WITH**NaNO2 + HCl
DHNO3, t, p**IS** (CH3CO)2O + HNO3k.

10

Product of complete hydrogenation of thiophene



AND2,3,4,5-Tetrahydrothiophene**IN**2,3-DihydrothiopheneWITH3,4-Dihydrothiophene
D1,2-Dihydrothiophene**IS** 1,2,3,4,5-Pentahydrothiophene

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. 3-membered heterocycles, their structure.

2. 4-membered heterocycles, their name.

3. Properties of furan and thiophene, their derivatives.

4. 5-membered heterocycles with two heteroatoms, their structure and properties.

5. Pyrazolone-5, its synthesis and properties.

6. Pyridine acids.

7. Nicotinic acid, its derivatives.

8. Structure of azepines and diazepines.

9. Quinoline and its derivatives.

10. The essence of the murexide test and its use in pharmaceutical analysis.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p.p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Lactim-lactamnatautomerism	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh -

			Kharkiv.: View of the NfaU; Original, 2008. p. 423-612
2.	Heterocycles with one heteroatom.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 423-612
3.	Heterocycles are condensed.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 423-612

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.

4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 54.

Topic: General characteristics of carbohydrates.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Hexoses. Glucose. Fructose.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes

the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Carbohydrates in nature, their role and classification.
2. Structure and stereoisomerism of monosugars.
3. Aldo- and ketopentoses.
4. Cyclic forms of monosaccharides, their conformation.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):

task content:

1 Oxidation of monosaccharides.

2. Pentose synthesis in laboratory conditions.

3. Reaction of fermentation of monosaccharides (alcoholic, lactic, citric).

4. Which reaction can be used to distinguish glucose from fructose?

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	Main tasks	Instructions	Answers
1.	**2**	**3**	**4**
1.	Epimerization	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 654-694
2.	Heworth's formulas	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 654-694
3.	Heterocycles are condensed.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 654-694

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
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7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 55.

Topic: Monosaccharides.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Hexoses. Glucose. Fructose.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Tautomerism of monosugars, their forms.

2. Chemical properties of monosaccharides.

3. Extraction of monosaccharides.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Qualitative reaction to fructose.
2. Glucose solutions as medicinal products.
3. Give schemes of interaction of D-fructose with an excess of phenylhydrazine.
4. Write schemes of sequential reactions for the production of ascorbic acid from D-glucose.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Epimerization	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 654-694
2.	Heworth's formulas	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 654-694
3.	Heterocycles are condensed.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic

			chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 654-694

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
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4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 56.

Topic: Disaccharides. Reducing and non-reducing disaccharides.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Cyclo-oxo-tautomerism. Reducing and non-reducing disaccharides.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Disaccharides in nature, their composition and properties.

2. Restorative disaccharides. Lactose, maltose.

3. Non-reducing disaccharides. Sucrose - chemical composition and arrangement of atoms.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Inversion of sucrose. Invert sugar.
2. Cellobiose, its composition and biological role.
3. Lactose is milk sugar, its biological role.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Cellulose.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 706-731
2.	Starch.	Characteristics of the specified	Chernykh V.P., Zimenkovskyi

		concepts	B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 706-731
3.	Polysaccharides.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 706-731

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
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Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
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8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 57.

Topic: Polysaccharides.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Cyclo-oxo-tautomerism. Reducing and non-reducing disaccharides.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes

the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. The structure of sucrose molecules, its properties and applications.
2. Production of sucrose in industry.
3. Maltose: molecular structure and chemical properties.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Relationship of disaccharides to hydrolysis.
2. Detection of hydrolysis products.
3. Tautomerism of reducing disaccharides.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**

1.	2	3	4
1.	Cellulose.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 706-731
2.	Starch.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 706-731
3.	Polysaccharides.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 706-731

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 58.

Topic: Squirrels
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Coagulation.Peptides. Polypeptides.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1.Nomenclature and production of proteins.

2.Chemical properties.

3.Protein identification methods.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.):

task content:

1. What amino acids are used in the food industry?
2. The essence of the protein coagulation reaction.
3. Protein precipitation reactions.
4. Xanthoprotein, biuret and cysteine reactions to proteins.

recommendations (instructions) for performing tasks orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Peptides.	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 745-757
2.	Squirrels	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 745-757
3.	Amino acids	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3

			books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 745-757

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
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the field of biomedical sciences.

3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.

4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 59.

Topic: Lipids.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Saponification Liquid fats. Solid fats.

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;
- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Saponified lipids, their occurrence in nature and classification.
2. Liquid fats, their properties
3. Solid fats, their properties
4. Unsaturated properties of fats.
5. Extraction, properties and nomenclature of fats.

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1. Biological role of lipids.
2. The effect of fats on the body.
3. The history of the development of research in the field of lipids.
4. Nomenclature of lipids.
5. Biosynthesis of lipids in the body.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Solid fats	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 762-795
2.	Liquid fats	Characteristics of the specified	Chernykh V.P., Zimenkovskyi

		concepts	B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 762-795
3.	Saponified lipids	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 762-795

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
2. General workshop on organic chemistry / V.P. Chernykh, I.S. Hrytsenko, M.O. Lozinskyi, Z.I. Kovalenko; Under the editorship V.P. Black people – Kh.: NfaU Publishing House; Golden Pages, 2003. – 592 p.
3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.

7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.
8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

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3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.

Practical lesson 60.

Topic: Thematic control work on topics 38-41.
Goal:get acquainted with the chemical properties of substances.
Basic concepts: Carbohydrates Squirrels Fats

Equipment:visual material, multimedia projector.

Plan

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge: frontal survey.
Requirements for students' theoretical readiness to perform practical classes
the student should know:

- homologous series;
- means of obtaining;
- basic chemical properties;

- to identify substances of this class of compounds

the student should be able to:

- interpret the electronic structure of substances;
- write different isomeric formulas and name them,
- choose methods of synthesis of substances;
- determine the chemical properties of compounds;

List of didactic units:

- textbook text
- a bank of test tasks.

Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

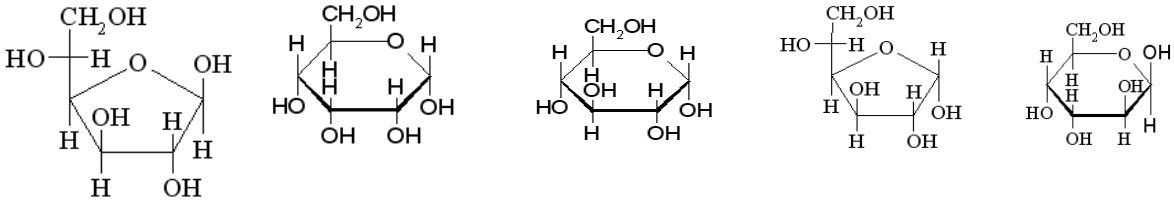
1

Starch is hydrolyzed to:

ANDMannose**IN**Ribozy**WITH**Galactose**D**Glucose**IS**Fructose

2

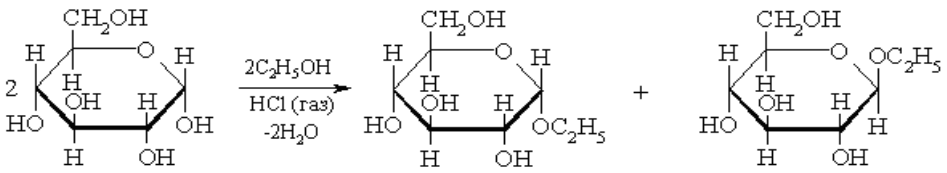
The formula of α-D-glucopyranose?



A V S D E

4

Cyclic forms of glucose with alcohols form cyclic acetals, which are called:

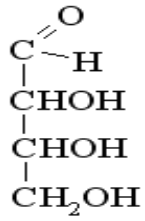


ANDComplex ethers**IN**Simple ethers**WITH**Ozazones

DGlycosides**IS** Hemiacetals

5

Specify the number of stereoisomers for a compound of isomers with the formula N=2n.



AND4 B 2 C 5 D 6 E3

6

The product of the reaction of D-galactose with hydrocyanic acid:

ANDAmine**IN**Phenylhydrazone**WITH**Hydrazone**D**Oxime**IS**Hydroxynitrile

7

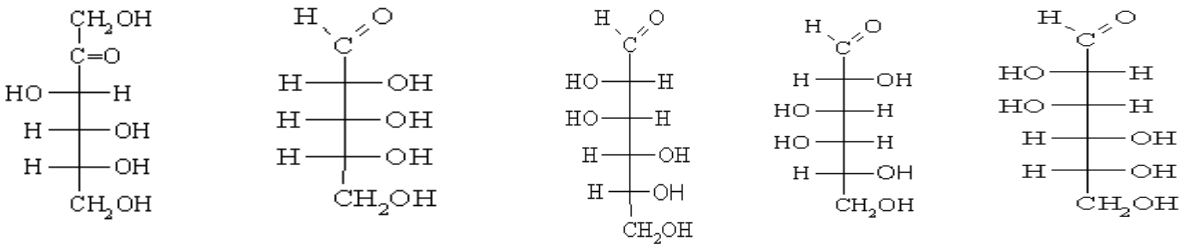
In a slightly alkaline environment, fructose can give a "silver mirror" reaction.
ANDFructose and glucose are diastereomers**IN**Fructose and glucose are isomers
WITHFructose and glucose are enantiomers**D**Fructose mutates
IS In a slightly alkaline environment, it can turn into glucose

8

Disaccharide formed during hydrolysis of starch?
ANDGalactose**IN**Saccharose**WITH**Cellobiose**D**Maltose**IS**Lactose

9

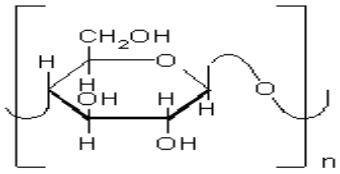
Identify which monosaccharide is an aldopentose?



A V S D E

10

Name the monosaccharide from whose residues cellulose was formed



ANDα-D-glucopyranose**IN**β-D-glucopyranose**WITH**β-D-fructopyranose
Dα-D-fructofuranose**IS**β-D-glucofuranose

3. Formation of professional abilities and skills (mastery of skills..., conducting curation, determining the treatment scheme, conducting laboratory research, etc.): task content:

1 Biological role of lipids.
2 The effect of proteins on the body.
3 The history of the development of research in the field of monosaccharides.
4 Nomenclature of carbohydrates.
5. Biosynthesis of lipids, proteins, glucose in the body.

- recommendations (instructions) for performing tasks, orienting maps for the formation of practical skills

No.p. p.	**Main tasks**	**Instructions**	**Answers**
1.	**2**	**3**	**4**
1.	Fats	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 688-795
2.	Squirrels	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3

			books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 688-795
3.	Carbohydrates	Characteristics of the specified concepts	Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. p. 688-795

- requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summing up

As a result of the class, miners are familiar with the chemical properties of substances.

5. List of recommended literature.

Main:

1. Chernykh V.P., Zimenkovskyi B.S., Hrytsenko I.S. Organic chemistry: In 3 books/ Ed. V.P. Chernykh - Kharkiv.: View of the NfaU; Original, 2008. – 752 p.
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3. Biological and bioorganic chemistry: teaching. study guide universities/A.A. Mardashko, L.M. Myronovych, G.F. Stepanov. - K.: Caravella, 2008. - 248 p.
4. Chernykh V.P. Lectures on organic chemistry - Kh.: NFaU; Golden Pages, 2005. - 480 p.
5. Grandberg I.O., Nam N.L. Organic chemistry. Textbook for universities. - K.: Drofa, 2009. - 375 p. 6. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 3. - Kh.: State enterprise "Ukrainian Scientific Pharmacopoeia Center for the Quality of Medicinal Products", 2009. - 280 p.
7. State Pharmacopoeia of Ukraine. - 1st ed., Addendum 2. - Kh.: State enterprise "Scientific-expert pharmacopoeial center", 2008. - 620 p.

8. State Pharmacopoeia of Ukraine. – 1st ed., Addendum 1. – Kh.: RIREG, 2004. – 494 p.
9. State Pharmacopoeia of Ukraine. - 1st edition. - Kh.: RIREG, 2001. - 556 p.

Additional:

1 Zimenkovsky B.S., Muzychenko V.A., Nizhenkovskaya I.V. Biological and bioorganic chemistry. Volume I: - Kyiv: Medicine, 2014: 398p.
2 Stoker, HS (2001). Organic and biological chemistry. Houghton Mifflin. 556

Information resources:

1 www.ncbi.nlm.nih.gov/PubMed - free access to the scientific database in the field of biomedical sciences.
2 https://pubchem.ncbi.nlm.nih.gov/ free access to the scientific database in the field of biomedical sciences.
3 www.bpci.kiev.ua is the official website of the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.
4 www.bioorganica.org.ua is a scientific publication presenting works on bioorganic and medicinal chemistry.