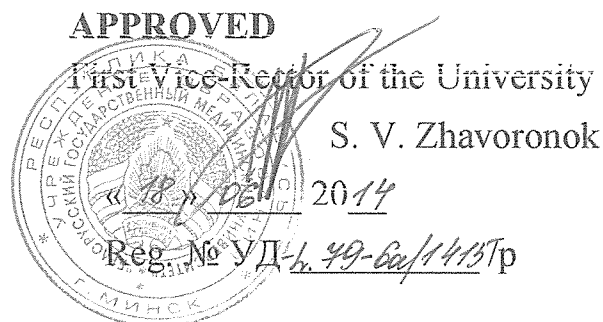
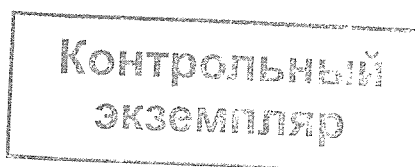


MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS

EDUCATIONAL ESTABLISHMENT

BELARUSIAN STATE MEDICAL UNIVERSITY



CHEMISTRY

Curriculum for Students of the Preparatory Courses of the Faculty of Career Guidance and Pre-University Training

Faculty **Career Guidance and Pre-University Training**
Department **General Chemistry**
Academic year **1**

Lectures	-	Forms of assessment:	Term
Practical training	155	examination	1
Laboratory studies	-	credit	-
Total hours of classroom studies	155	differentiated credit	-
Total hours for study	155 hours	state examination	-

The form of higher education full-time

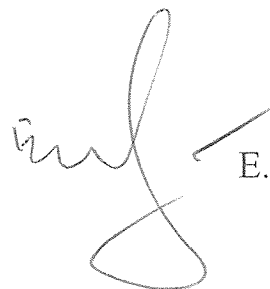
Compilers: E.V. Barkovsky, Doctor of Biological Sciences, PhD, Professor;
V.V. Khrustalev, Candidate of Biological Sciences, PhD,
Associate Professor

Minsk BSMU 2014

Recommended for approval by the Department of General Chemistry of Educational Establishment "Belarusian State Medical University"

« 16 » 05 2014 (protocol № 10)

Head of the Department, Professor



E.V. Barkovsky

Accepted and recommended for approval by methodical committee of Biomedical Sciences of Educational Establishment "Belarusian State Medical University"

« 18 » 06 2014 (protocol № 9)

Chairman, Professor



R. G. Zayats

EXPLANATORY NOTE

The program of the “Chemistry” subject for attendees of the pre-university courses has been composed taking into account the total number of hours available for that subject.

The aim of the program is to prepare foreign attendees for the entrance exam and for understanding such disciplines as “General Chemistry” and “Organic Chemistry” which they will study in the first year.

The main purposes of the “chemistry” program are based on the content of the entrance exam:

- knowledge of the main concepts and laws of chemistry;
- knowledge of the main types of inorganic and organic compounds and reactions between them;
- skills of the usage of the periodic table of elements and knowledge on the main trends existing inside it;
- knowledge of properties of chemical elements and their compounds;
- skills of application of theoretical concepts in chemistry for solving typical tasks for calculation and writing equations of chemical reactions.

THE PROGRAM OF THE DISCIPLINE “CHEMISTRY” FOR ATTENDEES OF THE PRE-UNIVERSITY COURSES OF BSMU

Part 1. Main concepts and laws of chemistry

The subject and aims of chemistry. Physical and chemical processes. Mixtures and compounds.

Atoms and molecules. Relative atomic and molecular mass. Mole as an amount of quantity of matter. Molar mass.

Chemical element, pure chemical element, compound. Chemical symbols and formulas. Stoichiometry. The law of the conservation of mass. Valence. Structural formulas. Mass percentage of the given element in the compound. Chemical equations. Avogadro’s law. Molar volume of gases.

Part 2. The Periodic table and the structure of atom

The Periodic table of chemical elements created by D. I. Mendeleev. Structure of the Periodic table. Dependences of certain features of chemical elements from their position in the Periodic table.

Structure of atomic nuclei and electron configurations for atoms from first four periods of the Periodic table. Isotopes. The Periodic table and the structure of atom.

Part 3. Chemical bonds and structure of matter

Types of chemical bonds: covalent (nonpolar and polar), ionic, hydrogen and metallic bonds. Examples of compounds with different types of bonds. Valence and oxidation state.

Classification of chemical reactions: combination, decomposition, single and double substitution reactions. Thermal effects of chemical reactions. Reduction-oxidation reactions and their balancing.

Part 4. Chemical kinetics and catalysis

The rate of chemical reaction. Dependence of the rate of chemical reaction on the nature of reactants, concentration and temperature.

Part 5. Main types of inorganic compounds

Oxides, their classification and nomenclature, physical and chemical properties. Production of oxides.

Bases, their classification and nomenclature, physical and chemical properties. Alkalis. Production of bases.

Acids, their classification and nomenclature, physical and chemical properties. Production of acids.

Salts, their classification and nomenclature, physical and chemical properties. Production of salts.

Chains of chemical reactions between main types of chemical compounds.

Part 6. Solutions. Electrolytic dissociation

Solutions. Solubility of substances. Dependence of solubility on the nature of substance, temperature and pressure. Thermal effects of solution formation.

Hydrates of salts. Quantitative description of solution content. Molarity. Mass percentage of solute in solution.

Electrolytic dissociation. Dissociation degree. Strong and weak electrolytes. Ionic equations. Electrolytic dissociation of acids, bases and salts. Hydrolysis of salts.

Part 7. Chemistry of elements

Hydrogen, its physical and chemical properties, production and applications. Water. The structure of water molecule. Physical and chemical properties of water.

Properties of halogens. Chlorine, its physical and chemical properties. Hydrogen chloride. Hydrochloric acid and its salts. Characteristic reaction for chloride anion.

Properties of elements from VIA group. Oxygen, its physical and chemical properties. Allotropy. Production of oxygen. The role of oxygen in Nature. Sulfur, its physical and chemical properties. Hydrogen sulfide. Oxides of sulfur. Sulfuric acid, its properties and production. Characteristic reaction for sulfate anion.

Properties of elements from VA group. Phosphorus, its allotropic modifications, physical and chemical properties. Phosphorus (V) oxide, phosphoric acid and its salts. Nitrogen, its physical and chemical properties. Ammonia and ammonium salts. Nitrogen oxides. Nitric acid. Nitrates.

Properties of elements from IVA group. Carbon and its compounds. Carbonic acid and its salts. Characteristic reaction for carbonate anion. Silicon. Silicon (IV) oxide. Silicates.

Metals, their position in the Periodic table, physical and chemical properties. Electrochemical series of metals.

Alkali metals and their properties. Compounds of sodium and potassium widespread in Nature, their applications.

Properties of elements from group IIA. Calcium, application of its compounds in medicine.

Aluminum. Amphoteric properties of its oxide and hydroxide. Iron, its oxides and hydroxides, dependence of their features on the oxidation state of iron.

Part 8. Organic chemistry

Theory of organic compounds structure created by A. M. Butlerov. Dependence between structure and chemical features. Isomers. Classification of organic compounds.

Alkanes – saturated hydrocarbons, sp^3 -hybridization of their carbon atoms, nomenclature, physical and chemical properties, production and applications.

Alkenes, sp^2 -hybridization of their carbon atoms, sigma and pi bonds, nomenclature, chemical properties, production and applications. Ethylene. Dienes, Polymerization reactions.

Alkynes, sp -hybridization of their carbon atoms, nomenclature, chemical properties, production and applications. Acetylene.

Arenes – aromatic hydrocarbons. Benzene, its electron structure, chemical properties. Benzene homologues. Toluene. Production of benzene and its homologues.

Alcohols. Classification and nomenclature. Physical and chemical properties. Methanol and ethanol, their applications. Ethylene glycol and glycerol, their applications.

Aromatic alcohols and phenols. Chemical properties of phenol in comparison with those of aliphatic alcohols. Applications of phenol.

Aldehydes, their structure and chemical properties. Production and application of methanal and ethanal.

Carboxylic acids, the structure of carboxylic group. Physical and chemical properties of carboxylic acids. Formic, acetic, stearic and oleic acids.

Esters, their structure, production and chemical properties. Fats, their chemical and physical properties.

Carbohydrates. Their classification. Glucose, its structure and chemical properties, production and applications. Fructose, ribose and deoxyribose.

Disaccharides. Sucrose, its structure, physical and chemical properties. Sucrose hydrolysis.

Polysaccharides. Starch and cellulose, their structure, chemical properties, role in Nature and applications.

Aliphatic and aromatic amines. Their physical and chemical properties.
Production of aniline from nitrobenzene.

Amino acids, their structure, chemical properties, production and applications.

Proteins. Their structure and biological roles.

THEMATIC PLAN
of practical lessons on chemistry for foreign English-speaking attendees of the
pre-university courses of BSMU

№ п/п	The topic	Number of hours
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I. Main concepts and laws of chemistry 18

1	Physical and chemical properties of substances. Atoms and molecules. Symbols of chemical elements.	3
2	Atomic mass and molecular mass. The mole and molar mass.	3
3	Valence. Chemical equations and their balancing.	3
4	Calculations using chemical equations.	3
5	Molar volume of gases. Relative densities of gases.	3
6	Control task #1	3

II. The periodic table and the structure of atom. 18

7	The overview of the Periodic table: distribution of metals and nonmetals between periods and groups. Average atomic masses. Isotopes.	3
8	Quantum numbers and electron configurations of elements.	3
9	Electronegativity and types of chemical bonds.	3
10	Oxidation state.	3
11	Classification of chemical reactions.	3
12	Balancing reduction-oxidation reactions.	3

III. Chemical kinetics and catalysis. 9

13	The rate of chemical reaction. Temperature coefficient.	3
14	Chemical equilibrium. Le Chatelier's principle.	3
15	Control task #2	3

IV. Main types of inorganic chemical compounds

18

16	Oxides: classification, physical and chemical	3
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	properties	
17	Bases: classification, physical and chemical properties	3
18	Acids: classification, physical and chemical properties	3
19	Salts: classification, physical and chemical properties	3
20	Chains of chemical reactions	3
21	Control work #3	3

V. Electrolytic dissociation **18**

22	Qualitative description of solutions. Solubility of chemical compounds in water.	3
23	Quantitative description of solutions. Mass percentage, molarity.	3
24	Electrolytic dissociation. Weak and strong electrolytes.	3
25	Ionic equations of chemical reactions.	3
26	Hydrolysis of inorganic salts.	3
27	Control work #4	3

VI. Introduction to the chemistry of elements. **36**

28	Chemistry of hydrogen and its compounds. Chemistry of water.	3
29	Chemistry of halogens and their compounds.	3
30	Chemistry of oxygen and its compounds.	3
31	Chemistry of sulfur and its compounds.	3
32	Chemistry of nitrogen and its compounds.	3
33	Chemistry of phosphorus and its compounds.	3
34	Chemistry of carbon and its compounds.	3
35	Chemistry of silicon and its compounds.	3
36	Chemistry of alkali metals and their compounds.	3
37	Chemistry of alkali-earth metals and their compounds.	3
38	Chemistry of aluminum and its compounds. Chemistry of iron and its compounds.	3
39	Control work #5	3

VII. Introduction to the organic chemistry**36**

40	Alkanes: nomenclature, physical and chemical properties.	3
41	Alkenes: nomenclature, physical and chemical properties.	3
42	Dienes: nomenclature, physical and chemical properties.	3
43	Alkynes: nomenclature, physical and chemical properties.	3
44	Arenes: nomenclature, physical and chemical properties.	3
45	Alcohols: nomenclature, physical and chemical properties.	3
46	Aldehydes and ketones: nomenclature, physical and chemical properties.	3
47	Carboxylic acids: nomenclature, physical and chemical properties.	3
48	Esters: nomenclature, physical and chemical properties. Fats: nomenclature, physical and chemical properties.	3
49	Carbohydrates: physical and chemical properties. Nucleic acids: physical and chemical properties.	3
50	Amines: nomenclature, physical and chemical properties. Proteins: physical and chemical properties.	3
51	Control work #6	3

VIII. Pre-exam training

52	Final control work	2
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Thematic plan and the program of the discipline "Chemistry" for English-speaking foreign attendees of pre-university courses of BSMU have been discussed and approved by the Department of General Chemistry on the «_» of ____ 2014, report № ____.

The head of the Department
of General Chemistry,
Professor

 Barkovsky E.V.

Recommended literature

Khrustalev V.V., Barkovsky E.V. Introduction to the general chemistry. BSMU, 2014.

Khrustalev V.V., Barkovsky E.V. Introduction to the chemistry of elements. BSMU, 2015.

Khrustalev V.V., Barkovsky E.V. Introduction to the bioorganic chemistry. BSMU, 2014.


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Authors:

Head of General Chemistry Department of
Educational Establishment «Belarusian State
Medical University»

Associate Professor of General Chemistry
Department of Educational Establishment
«Belarusian State Medical University»



E.V. Barkovsky



V.V. Khrustalev

Curriculum content, composition and accompanying documents conform to specified requirements.

Dean of the Faculty of Career Guidance and
Pre-University Training of Educational
Establishment «Belarusian State Medical
University» Associate Professor



Butvilovsky A.V.

Methodologist of Educational Establishment
«Belarusian State Medical University»



Kharitonova S.A.

« 18 » 06 20 14

Head of Foreign Languages Department of
Educational Establishment «Belarusian State
Medical University»
Associate Professor



Petrova M.N.

« 18 » 06 20 14

Data of the Curriculum authors (developers)

Name	Barkovsky Eugene Victorovich
Adress	Dzerzhinsky av., 83 220116, Minsk, Belarus
☎ office	(017) 272 52 95
E-mail:	comchem@bsmu.by

Name	Khrustalev Vladislav Victorovich
Adress	Dzerzhinsky av., 83 220116, Minsk, Belarus
☎ office	(017) 272 52 95