



«APPROVED»

Member of the Management Board,  
Vice-Rector for Operations  
NJSC «Al-Farabi KazNU»

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**The program of  
the entrance exam for the group of educational programs of the Faculty of  
Chemistry and Chemical Technology  
for bachelor's degree  
for foreign citizens to study on a paid basis**

**1. General Provisions**

1.1 The program was drawn up in accordance with the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018, No. 600 «On approval of the Model Regulations for admission to studies in educational organization, implementing educational programs of technical and vocational education» (hereinafter – the Standard Rules).

1.2 Entrance exams for bachelor's degree programs consist of two stages:

✓ At the first stage, foreign applicants take a test on general education subjects on the respective platform.

✓ At the second stage, they undergo testing to determine their proficiency level in the language of instruction.

1.3 The entrance exams are conducted in the form of testing for the following groups of educational programs:

- ✓ 6B07104 – Chemical Technology of organic substances
- ✓ 6B07103 – Chemical Technology of inorganic substances
- ✓ 6B05301 – Chemistry
- ✓ 6B07201 – Pharmaceutical production technology
- ✓ 6B05311 – Nanomaterials and nanochemistry
- ✓ 6B07202 – Food Chemistry and technology
- ✓ 6B07102 – Chemical Engineering

1.4 In case an international applicant is unable to come to the University to take the entrance exam in the form of testing, they have the opportunity to take it online.

1.5 Selection for admission of international applicants to bachelor's degree programs through testing is assessed on a 100-point scale.

1.6 Following the entrance exam for bachelor's degree programs, a test results sheet is compiled in the established format, which is signed by the management of the Office of Internationalization and Recruitment of Foreign Students.

1.7 Appeals regarding the results of the testing are allowed within 24 hours.

1.8 An appeals commission is established by the rector of al-Farabi Kazakh National

University for the period of exams. The appeals commission for admitting international applicants to KazNU includes employees of the Office of Internationalization and Recruitment (hereinafter referred to as the Office) and the teaching staff of KazNU.

1.9. The decision on admission is reviewed by the competition commission for the enrollment of international applicants and is documented by a protocol through the "Salem office" system.

1.10. Retaking the entrance exam is not allowed.

## **2. Conducting the entrance exam in 2024**

2.1 Testing is conducted in Russian, Kazakh, and English languages, including questions on relevant subjects within the framework of the general education school program.

2.2 An indicative list of topics for entrance exams in the format of testing:

1. The subject of chemistry. Chemical and physical phenomena.
2. Atomic-molecular theory. Atoms. Molecules. Relative atomic and molecular weight. The law of conservation of mass, its significance in chemistry. A mole is a unit of quantity of a substance. Molar mass. Avogadro's law and the molar volume of gas.
3. Chemical element. Simple and complex substances. Chemical formulas.
4. Valence. Compilation of chemical formulas for valence.
5. The structure of the atom. The composition of atomic nuclei. The physical meaning of the atomic number  
chemical element. The concept of an electronic cloud. Energy level and sublevel. S-, p-, d-orbitals in the atom.
6. The periodic law and the periodic system of chemical elements based on theory of atomic structure. The structure of the periodic table. Changes of the properties of chemical elements and their compounds by groups and periods of the periodic system.
7. Nature and types of chemical bonds. Formation of a covalent bond on the example of hydrogen and hydrogen chloride molecules. Polar and non-polar covalent bonds. Ionic bond. Hydrogen bonding.
8. Classification of chemical reactions according to various criteria. Types of chemical reactions: compounds, decomposition, substitution, exchange. Thermal effect of a chemical reaction. Thermochemical equations.
9. Redox processes. The degree of oxidation of the element. Oxidation and reduction as processes of addition and recoil of electrons.
10. The idea of the rate of chemical reactions. The dependence of the speed on the nature and concentration of reacting substances, temperature. Catalysis and catalysts.
11. Reversibility of chemical reactions. Chemical equilibrium and conditions, which affect the shift of the chemical equilibrium.
12. Solutions. Solubility of substances. The dependence of solubility on their nature, temperature and pressure. The mass fraction of the dissolved substance in the solution.
13. Electrolytes and non-electrolytes. Electrolytic dissociation. Strong and weak electrolytes. Chemical properties of acids, bases and salts in the light of the theory of electrolytic dissociation. Ion exchange reactions and conditions of their irreversibility.

14. Oxides. Classification of oxides. Methods of production and properties of oxides. The concept of amphotericity.
15. Grounds. Alkalis and insoluble bases. Methods of preparation and chemical properties.
16. Acids. Classification of acids. Methods of preparation and general chemical properties.
17. Salt. The composition of salts and their names. Preparation and chemical properties of salts. Hydrolysis of salts.
18. The relationship between different classes of inorganic compounds.
19. Metals, their placement in the periodic table. Physical and chemical properties. The main methods of industrial production of metals. Electrochemical series of stresses of metals.
20. Alkali metals, their characteristics based on their place in the the periodic system and the structure of atoms.
21. General characteristics of the elements of the main subgroup of the second group of the periodic system. Calcium, its compounds in nature. Water hardness and ways to eliminate it.
22. Aluminum, characteristics of the element and its compounds based on the placement in the periodic table and the structure of the atom. Physical and chemical properties of aluminum.
23. Metals of secondary subgroups (chromium, iron, copper). Physical and chemical properties. Oxides and hydroxides. Chromium, iron and copper salts.
24. Hydrogen, its chemical and physical properties. Production of hydrogen in laboratories, its use.
25. Halogens, their characteristics based on their place in the periodic table and the structure of atoms. Chlorine. Physical and chemical properties. Hydrogen chloride. Hydrochloric acid and its salts.
26. General characteristics of the elements of the main subgroup of the sixth group of the periodic system. Sulfur, its physical and chemical properties. Hydrogen sulfide and sulfides. Sulfur oxides. Sulfuric acid, its properties and chemical bases of contact production. Salts of sulfuric acid.
27. Oxygen, its physical and chemical properties. Allotropy. Receiving oxygen in the laboratory and industry. The role of oxygen in nature and its use in technology.
28. Water. Electronic and spatial structure of the water molecule. Physical and chemical properties of water.
29. General characteristics of the elements of the main subgroup of the fifth group of the periodic system. Phosphorus. Phosphorus oxide, phosphoric acid and its salts. Phosphoric fertilizers.
30. Nitrogen, its physical and chemical properties. Ammonia. Physical and chemical properties. Nitric acid. Salts of nitric acid. Nitrogen fertilizers.
31. General characteristics of the elements of the main subgroup of the fourth group the periodic table. Silicon, its physical and chemical properties. Silicon oxide and silicic acid.
32. Carbon, its allotropic forms. Chemical properties of carbon. Carbon oxides, their chemical properties. Carbonic acid, carbonates and bicarbonates, their properties.
33. The subject of organic chemistry, its place among other chemical and natural disciplines. Classification. The structure of the carbon atom. Isomerism, nomenclature, classification of organic compounds. Classification of organic reactions: radical, electrophilic, nucleophilic.

34. Alkanes. Electronic and spatial structure, methods of production, physical and chemical properties. Processing of methane. The scheme of production of the most important products based on methane.

35. Alkenes and alkadienes. The nature of the double bond, chemical properties. Reactions of joining by double bond.

36. Alkynes. Classification. The nature of the triple bond. Properties of alkynes. Reactions of electrophilic addition (hydrohalogenation, halogenation, Kucherov reaction). The reaction of nucleophilic addition.

37. Acetylene is a raw material for the synthesis of alkylvinyl esters, acrylonitrile, vinyl acetate, tetrachloroethylene, etc. The scheme of production of the most important products based on acetylene.

38. Aromatic hydrocarbons: specific structure, aromaticity. Chemical properties.

39. Hydroxyl-containing compounds, nomenclature, electronic structure. Chemical properties of primary, secondary, tertiary alcohols, phenols

40. Carboxylic acids Classification, structure, isomerism, nomenclature. Chemical Properties

41. Amino acids, methods of their preparation and chemical properties. Amphoteric properties.

42. Carbohydrates. The structure of monosaccharides. Stereoisomerism. Heurs formulas. Mutarotation. Racemates. Chemical properties.

### 2.3 List of recommended literature for preparation:

1. Khomchenko G.P. Khimiya. Posobie dlya postupayushhikh v vuzy. (any edition, in Russian)

2. Kuz`menko N.E., Eremin V.V., Popkov V.A. Nachalo khimii. (any edition, in Russian)

3. Vrublevskij A.I. Trenazher po khimii. – Minsk: Krasiko-Print, 2009. (in Russian)

4. Bekishev K. Khimiya esepteri. – Almaty: Qazaq universiteti, 2018. – 200 b. (in Kazakh)

5. Bekishev K., Myltyqbaeva L.K. Khimiyalyq reaksiyalar tizbekteri. - Almaty: Qazaq universiteti, 2019. – 110 b. (in Kazakh) Paula Jurkanis Bruis (translation) Fundamentals of Organic Chemistry Part 1, 2013, Part 2 2014

6. Petrov, AA. Organic chemistry. -Almaty, 1975

7. Traven VF Organic Chemistry.M: Akademkniga, 1,2 2004.

8. Morrison R., Boyd. Organic chemistry. M: Mir, VS, 1990

9. Shabarov, Yu.S. Organic chemistry. -M., 2000

10. Nesmeyanov, AN Beginning of organic chemistry. -M., 1974

11. Neyland, O.Ya. Organic chemistry. -M., 1990

## **3 Criteria for evaluating the entrance exam for admission to the bachelor's program for foreign citizens on a fee-paying basis:**

3.1 Selection for admission of foreign applicants to bachelor's degree programs through testing is assessed on a 100-point scale. A minimum of 65 points is required for admission on a

fee-paying basis to the bachelor's program.

3.2 At the first stage of preliminary selection for bachelor's degree programs, applicants take a test covering materials on general education disciplines related to the chosen specialty. The test consists of 100 questions (20 questions per test, with 5 points awarded for each correct answer).

3.3 To pass the test successfully, a foreign applicant must correctly answer at least 13 out of 20 questions, which is equivalent to 65%, regardless of the language chosen for testing.

3.4 At the second stage of selection for bachelor's degree programs, applicants take a language proficiency test:

- ✓ For programs with English as the language of instruction, applicants must correctly answer at least 21 out of 30 questions, which is equivalent to 70%.

- ✓ For programs with Russian or Kazakh as the language of instruction, applicants must correctly answer at least 15 out of 30 questions, which is equivalent to 50%.