«APPROVED»
Member of the Board- vice-rector
for academic affairs
NJSC «Al-Farabi KazNU»
_____ Kazmagambetov A.G.
«___» _____ 2025

Entrance-Exam Program
for the group of PhD program educational programs of the Faculty of Chemistry and Chemical Technology
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. In Al-Farabi KazNU for educational programs of postgraduate education (doctoral studies) are admitted persons who have mastered educational programs of postgraduate education. The admission to the doctoral program is allowed to applicants who have a "Master's" degree.

1.3. Entrance examinations according to Annex 2 of the Standard Rules are held **in as an interview** for the following groups of educational programs:

- 8D05301 – Chemistry
- 8D07101 – Petrochemistry
- 8D07102 – Chemical Engineering
- 8D07103 – The Chemical Technology of Explosives and Pyrotechnics
- 8D07104 – Chemical Technology of Inorganic Substances
- 8D07105 – Chemical technology of organic substances
- 8D07113 – Nanomaterials and Nanotechnologies in Chemistry

1.4 To conduct entrance examinations for a foreign applicant an examination committee is created by the decision of the rector of AL-FARABI Kazakh National University for the period of examinations.

The commission includes employees of the Internationalization and Recruiting Office (hereinafter referred to as the Office) and the professor-teaching staff of Al-Farabi KazNU.

1.5 If a foreign applicant who meets the above requirements has no possibility to come to the University for an entrance interview, he has the opportunity to take it online.

1.6 Entrance exam in the form of oral conversation (interview) for a foreign applicant is assessed by a 100-score system. The minimum score for enrollment on a paid basis is 75.

1.7 Based on the results of the entrance exam, an interview protocol is prepared according to the requirements of the Office. The interview protocol is signed by the chairman and all members of the commission present and submitted to the Office.

1.8 The decision on admission is made by the University Admissions Committee based

on the results of the interview. The results of the entrance exam are announced on the same day.

1.9 Retaking the entrance exam is not permitted.

1.10. An appeal based on the results of the interview is provided within 24 hours.

2. Conducting the entrance exam in 2025

2.1 The interview is conducted in Russian, Kazakh and English. The oral interview also contains questions aimed at revealing the ability to learn, creative activity and critical thinking, personal qualities of the applicant.

2.2 An indicative list of interview topics:

1. Basics of scientific method.
2. Literature research. Search engines and databases of scientific information.
3. Planning and realization of research experiments. Protocol of research experiment.
4. Preparation and writing of scientific articles.
5. Presentation of scientific results and ideas to the scientific community.
6. Preparation and writing of scientific projects. Realization of scientific project.
7. Search for funding sources for scientific projects.
8. Commercialization of scientific results. Protection of intellectual property.
9. Research ethics. Responsibility for non-compliance of ethical principles.
10. Innovative methods for the synthesis of nanostructured materials in inorganic chemistry: from chemical precipitation to hydrothermal synthesis.
11. The role of the shape and size of nanostructures in determining the properties of inorganic materials.
12. Modern methods for modifying the surface of nanoparticles to control their properties and reactivity.
13. Application of inorganic phosphorescent materials in LEDs and displays: from quantum dots to phosphors.
14. The influence of structure and composition on the effectiveness of phosphorescent materials and methods for their improvement.
15. New approaches to catalysis and catalysts in inorganic chemistry: organometallic complexes, nanocatalysis and heterogeneous catalysts.
16. Application of organometallic compounds in the development of effective catalysts for organic syntheses: from metal complexes to organometallic catalysts.
17. The influence of the structure and composition of catalysts on their activity and selectivity in chemical reactions.
18. The role of inorganic materials in the development of energy-efficient technologies: solar panels, batteries and hydrogen fuel cells.
19. Use of nanomaterials as electrodes and catalysts in energy-chemical devices.
20. Application of heterostructure materials in photocathode and photoelectrochemical systems.
21. New approaches to the development of inorganic materials with high thermoelectric efficiency.
22. Modern methods for characterizing the structure and properties of inorganic materials: from

spectroscopy to microscopy.

23. Application of machine learning and computational methods to predict the properties and design of new inorganic materials.
24. The role of synthetic biology and nanobiotechnologies in the development of new functional inorganic materials and devices.
25. Physical and chemical methods of formation of nanosystems.
26. Technologies of practical application of nanomaterials
27. Basic technologies for obtaining nanomaterials
28. Nanotechnology for coating, material processing, and their implementation in industrial enterprises
29. Formation of thin-film systems of complex composition from metal, polymer ceramic and inorganic components
30. Principles of modern organic synthesis and determination of the structure of organic compounds: Selection of the optimal synthesis route.
31. Modern adsorption, absorption and chemisorption technologies. Modern oil refining technologies. Modern technologies for processing natural and associated gases.
32. Modern extraction processes. Modern technologies for the production of alkenes. Modern technologies for the production of alkadienes.
33. Modern rectification processes. Modern technologies based on acetylene. Modern technologies for the production of cyclohexane and arenes
34. Modern oxidation technologies in industrial organic chemistry.
35. Modern halogenation processes. Modern technologies for the production of chloroalkanes and chloroarenes.
36. Modern processes of isomerization and condensation in industrial organic chemistry. Oxosynthesis technology. Technologies for producing alcohols.
37. Modern processes of hydrogenation and dehydrogenation in industrial organic chemistry. Modern technologies for producing polyols. Processes of hydrolysis, esterification, hydration and dehydration.
38. Modern technologies for the production of flotation reagents. Alkylation technology. Technologies for the production of ethylene oxide and propylene oxide.
39. Modern technologies for the production of plant protection products. Modern technologies for the production of aldehydes. Modern technologies for the production of ketones.
40. Modern technologies for producing fragrant substances. Modern technologies for the production of saturated carboxylic acids. Modern technologies for the production of unsaturated and aromatic carboxylic acids.
41. Modern technologies for producing surfactants. Modern technologies for the production of carboxylic acid anhydrides. Modern technologies for the production of carboxylic acid nitriles.
42. Modern technologies for producing painkillers. Modern technologies for producing amines. Modern technologies for the production of sulfonic acids.
43. Modern technologies for producing dyes. Freon production technology. Technology for the

production of nitrogen derivatives of carbonic acid.

44. Technology for producing film-forming and binding materials. Modern technologies for the production of vinyl acetate. Oxidative methylation technology.
45. Principles of creating waste-free production. Combination as a method of improving technology

2.3 List of recommended literature for preparation:

1. Semchikov Yu.D. High-molecular compounds: Textbook for universities. M.: Academy, 2003, 368 (in Russian).
2. Vlasov S.V., Kandyrin L.B., Kuleznev V.N., Markov A.V., Simonov-Emelyanov I.D., Surikov P.V., Ushakova O.B. Fundamentals of plastics processing technology // textbook for universities. M .: Mir, 2006, - 600 p. (in Russian).
3. Ergozhin E.E., Zezin A.B., Suleimenov I.E., Mun G.A. Hydrophilic polymers in nanotechnology and nanoelectronics (monograph) / Library of nanotechnology, Almaty, Moscow: LEM, 2008, 214 p. (in Russian).
4. Mun G.A., Suleimenov I.E., Zezin A.B., Abilov Zh.A., Dzhumadilov T.K., Izmailov A.M., Khutoryanskiy V.V. Complexation with the participation of polyelectrolytes: Theory and prospects for use in nanoelectronics (monograph) / Library of nanotechnology. Issue 2. Almaty - Moscow-Toronto - Reading: Publishing house LEM, 2009, 256 p. (in Russian).
5. N.N. Lebedev Chemistry and technology of basic organic and petrochemical synthesis, 6th ed. - M .: Chemistry, 2006 .-- 592p. (in Russian).
6. V.S. Timofeev, L.A. Serafimov. Principles of the technology of basic organic and petrochemical synthesis. - 3rd ed. - M.: VSh, 2007.-536s. (in Russian).
7. V.V.Kafarov, K.N.Dorokhov, E.M. Koltsova. System analysis of the processes of chemical technology. - M.: Chemistry, 2003. -368p. (in Russian).
8. V.V. Kafarov. The principles of creating waste-free chemical production. - M .: Chemistry, 1996. - 288p. (in Russian).
9. R.A.Muzychkina, D.Yu. Korulkin, Zh.A. Abilov. Production technology and analysis of phytopreparations. - Almaty: Kazakh University, 2011. - 356 p. (in Russian).
10. Reutov O.V., Kurtz A.L., Butin K.P. Organic chemistry M.: Laboratory of knowledge. - 2004. In 4 books. (in Russian).
11. Iliel E. Fundamentals of stereochemistry. M.: Binom. Knowledge laboratory. – 2005 (in Russian).
12. Iliel E., Weiden S., Doyle M. Foundations of organic stereochemistry. M.: Binom. Knowledge laboratory. - 2007. -- 703 p. 19. Lee JJ. Name reactions. Mechanisms of organic reactions. M.: Binom. Knowledge laboratory. - 2006. -- 456 p. (in Russian).
13. Keri F, Sandberg R. Advanced course in organic chemistry. M.: Chemistry, - 1981. - T. 1,2. (in Russian).
14. Potapov V. Stereochemistry, Moscow: Chemistry. - 1990. (in Russian).
15. Hofmann A. Scientific writing and communication: Papers, Proposals, and Presentations. - Oxford University Press, 2009. - ISBN 01953-90059
16. Carter M. Designing Science Presentations: A Visual Guide to Figures, Papers, Slides, Posters, and More. - Academic Press, 2013. - ISBN 01238-59697

17. Carey S.S. A Beginner's Guide to Scientific Method. – Wadsworth Publishing, 2003. – 160 p.
18. Gauch H.G. Scientific Method in Practice. - Cambridge University Press, 2002. - 456 p.
19. Reardon D. Doing your undergraduate project. - Sage Publications, 2006. - ISBN 978-0761942078
20. V.A. Smith., A.D. Dilman. Fundamentals of modern organic synthesis. M .: Binom, 2009 750 p. (in Russian).
21. Smith V., Bochkov A., Capel R. Organic synthesis. Moscow: 2001. (in Russian).
22. Nanochemistry in the near future. Moscow: 2002 (in Russian).
23. Kartamysheva E.S., Ivanchenko D.S. New technologies for processing industrial waste in the modern world // Young scientist. 2017. No. 51. S.15-118. (in Russian).
24. Advances in chemistry. 1998-2010 (in Russian).
25. Journal of Organic Chemistry. 2000-2010 (in Russian).
26. Journal of the Russian Society. DI. Mendeleev. 1999-2008 (in Russian).
27. Petrochemistry. 1998-2010 (in Russian).
28. Tolstikov A.G., Tolstikov G.A. and other Modern problems of asymmetric synthesis. Yekaterinburg. 2008.207 p. (in Russian).
29. Z.A. Mansurov. T.A. Shabanova Synthesis and technology of nanostructured materials. - Almaty, "Kazakh University", 2008. - 208 p.
30. Andrievsky R.A., Ragulya A.V. Nanostructured materials. Uch. allowance. - M .: Publishing Center "Academy", 2005. - 117 p.
31. Poole Ch., Owens F. Nanotechnology. Moscow: Technosphere, 2004.
32. Harris P. Carbon nanotubes and related structures. New materials of the XXI century. - M .: Technosphere, 2005. 5. Kobayasi N. Introduction to nanotechnology. - M .: BINOM, 2007 . - 134 p.

3. Scale and assessment criteria of the entrance examination for admission to the doctoral program for foreign citizens on a fee-paying basis:

Number of points	Compliance criteria
90–100 points «Excellent»	Demonstrates knowledge of the fundamental processes within the studied subject area; depth and completeness of addressing the issue; logically and sequentially expresses own opinion on the discussed problem; possesses conceptual-categorical framework, scientific terminology; logical coherence of the answer, adherence to the norms of contemporary scientific language.
80–89 points «Good»	Competent use of scientific terminology; mastery of conceptual-categorical framework; problem-oriented presentation of formulated questions; occasional errors in presenting factual material; incompleteness in presenting scientifically established facts within the scope of questions; logical coherence of the answer, adherence to the norms of contemporary scientific language.

75–79 points «Satisfactory»	Insufficient use of scientific terminology; inadequate mastery of conceptual-categorical framework; ability to address only one of the problems formulated in the questions; errors in presenting factual material; superficial knowledge of the subject area; violation of logical coherence in the answer, norms of contemporary scientific language.
0–74 points «Unsatisfactory»	Absence of necessary scientific terminology in the answers; descriptive presentation of discussed issues, inability to identify and present problems; gross errors in presenting factual material; lack of knowledge of historiography of the studied subject area.