

APPROVED
at a meeting of the Academic
Council of NJSC «KazNU named
after al-Farabi»
Protocol № 11 from 23. 05. 2025 y.

**The program of the entrance exam for applicants to the PhD
for the group of educational programs
D090 - «Physics»**

I. General provisions

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 Rules for Admission to Education in Educational Organizations Implementing Educational Programs of Higher and Postgraduate Education» (hereinafter referred to as the Model Rules).

2. The entrance exam for doctoral studies consists of writing an essay, an exam in the profile of a group of educational programs and an interview.

Блок	Баллы
1. Interview	30
2. Essay	20
3. Exam according to the profile of the group of the educational program	50
Total admission score	100/75

3. The duration of the entrance exam is 3 hours 10 minutes, during which the applicant writes an essay and answers the electronic examination ticket. The interview is conducted at the university premises before the entrance exam.

II. Procedure for the entrance examination

1. Applicants for doctoral studies in the group of educational programs D090 - «Physics» write a problematic / thematic essay. The volume of the essay is at least 250 words.

The purpose of the essay is to determine the level of analytical and creative abilities, expressed in the ability to build one's own argumentation based on theoretical knowledge, social and personal experience.

Types of essays:

- motivational essay revealing the motivation for research activities;
- scientific-analytical essay justifying the relevance and methodology of the planned research;
- problem/thematic essay reflecting various aspects of scientific knowledge in the subject area.

2. The electronic examination card consists of 3 questions

Topics for exam preparation according to the profile of the group of the educational program:

1. Basic Theorems of Particle Dynamics
2. Hamiltonian Formalism
3. Lagrangian Formalism
4. Charge in an Electromagnetic Field
5. Maxwell's Equations
6. Principles of Special Theory of Relativity
7. Fundamentals of Thermodynamics
8. Thermodynamic Functions
9. Fermi and Bose Gas
10. Wave Function
11. Quantum-Mechanical Description of Microsystems
12. Principles and Postulates of Quantum Mechanics

III List of references

Main:

1. L.D. Landau, E.M. Lifshitz, Mechanics
2. N.N. Bukholts, Basic Course of Theoretical Mechanics
3. L.D. Landau, E.M. Lifshitz, The Classical Theory of Fields. Moscow: Nauka, 1988
4. I.E. Tamm, Fundamentals of the Theory of Electricity
5. I.A. Kvasnikov, Thermodynamics and Statistical Physics (Theory of Equilibrium Systems). Moscow State University Press, 1991
6. A.I. Anselm, Fundamentals of Statistical Physics and Thermodynamics, 2nd ed. St. Petersburg: Lan, 2007, 423 p.
7. A.S. Davydov, Quantum Mechanics. St. Petersburg, 2011, 703 p.
8. E.V. Shpolsky, Fundamentals of Quantum Mechanics and Atomic Shell Structure, Vol. 2. Moscow, 2010, 448 p.

Additional:

1. I.I. Olkhovsky, Course of Theoretical Mechanics for Physicists
2. J.D. Jackson, Classical Electrodynamics
3. Yu.B. Rumer, M.Sh. Ryvkin, Thermodynamics, Statistical Physics, and Kinetics. Moscow, 2001
4. V.M. Varikash, A.I. Bolsun, V.V. Aksenov, Problem Book in Statistical Physics, 3rd ed., 2011
5. L.D. Landau, E.M. Lifshitz, Quantum Mechanics: Non-Relativistic Theory. Fizmatlit, 2008, 800 p.