МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

Федеральное государственное бюджетное образовательное учреждение высшего образования

«Вятский государственный университет»

(ВятГУ)

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Протокол заседания
Приемной комиссии
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PROGRAM EXPERIENCE TEST

the educational program of the master's degree in the direction of training: 18.04.02 Energy- and resource-saving processes in chemical technology, petrochemicals and biotechnology.

profile: Recycling technologies for material resources
(The program is implemented in English)

Kirov, 2020

1. Explanatory note

The entrance test program includes a list of questions, typical tasks and a list of literature to prepare for admission to the master's degree in the direction of training 04/18/02 Energy and resource saving processes in chemical technology, petrochemistry and biotechnology .. The program contains the basic requirements for knowledge, skills and abilities, presented to applicants entering the magistracy in the direction of preparation 04/18/02 Energy and resource saving processes in chemical technology, petrochemistry and biotechnology.

The purpose of the entrance test: to assess the level of knowledge of applicants in the subject "Chemistry of the Environment" and to accept for training in the magistracy in the direction of preparation 04/18/02 Energy and resource-saving processes in chemical technology, petrochemistry and biotechnology. Applicants who have shown a high level of preparation in the subject.

Requirements for the applicant:

Must know:

1. Basic concepts of environmental chemistry;
2. Chemical composition of geospheres and biosphere;
3. Chemical reactions in the environment;
4. Biogeochemical cycles of biogenic elements;
5. The main directions of destruction and biotransformation of pollutants.
6. Environmental problems of pollution of natural environments and objects.

Should be able to:

1. Solve design problems for the main sections of environmental chemistry;
2. Write down the equations of chemical reactions in the environment.
3. Simulate the chemical processes occurring in nature.

Must own:

1. Techniques for writing equations of chemical reactions in the environment;
2. Skills of research work on the study of natural environments and objects;
3. Skills of working with literature and information retrieval.

2.Contents of the entrance test program

Section 1. Introduction

Subject "Chemistry of the Environment". The connection of ecology with chemistry, biology and other subjects. Changing nature under the influence of human activities.

Section 2. Chemistry of the biosphere

Topic 2.1. The doctrine of the biosphere

The concept of the biosphere, its boundaries. The biosphere is a universal ecosystem of the Earth. Types of matter in the biosphere. Functions of living matter. Continuous cycles of substances and energy (laws of thermodynamics). The variety of connections between the

components of the biosphere. Chemical elements in the biosphere (biogenic, secondary). Macronutrients and trace elements.

Section 3. Chemistry Atmosphere

Theme 3.1. Structure, composition, basic characteristics of the atmosphere

The composition, structure and characteristic of the Earth's atmosphere. Unlimited atmosphere, transparency, temperature.

Theme 3.2. Chemical reactions in the atmosphere

Chemical reactions in the atmosphere. Photodissociation, photoionization. Reactions of ions in the atmosphere: charge transfer, exchange, dissociative recombination

Theme 3.3. Environmental problems of atmospheric chemistry

Are the overall characteristic and function of the ozone layer. The formation and destruction of ozone in the atmosphere. The zero ozone cycle. Hydrogen, nitrogen, chlorine and bromine cycles of ozone. The reactions of a chain break in the processes that cause ozone destruction. The ozone hole over Antarctica. International agreements aimed at preserving the ozone layer. Could. Wet smog. Photochemical smog. Acid rains. Radioactive air pollution. Radioactivity. Natural and artificial radioactivity.

Section 4. Hydrosphere Chemistry

Theme 4.1. Water in nature

Abnormal properties of water: dependence of water density on temperature, heat intensity of water, specific enteripia of evaporation, surface tension, dielectric permeability. The origin of all the waters of the Earth. Hypotheses: primary dust cloud; the formation of water from primary hydrogen, oxygen; "Sunny wind." The role of water for the Earth's surface climate, life processes. The nature of water purification.

Theme 4.2. Wastewater. How to clean water

Clean and contaminated water. Biochemical need for oxygen (BPC), chemical need for oxygen (COD). Elements of water toxicology. The main sources of water pollution. Wastewater: concept, classification. Wastewater treatment, treatment stage. Chemical methods of cleaning (sorbation activated charcoal, neutralization, coagulation, electrodiase, electroflotation, electrocatalysis). Problems and ways to clean drinking water. Chlorination, zoning, deposition, ion exchange, extraction in the purification of drinking water. Methods of separating coarse, fine dispersion and dissolved impurities in water. Features of biological water purification.

Section 5. Chemistry lithosphere

Theme 5.1. The structure, composition of the lithosphere

The lithosphere. Earth structure, geosphere, volume, mass. Chemical elements and minerals of the earth's crust. Rocks. Ore. Earth resources: fuel and energy, resources of metals and non-metals. Resource Use Index (IRGC). Stocks and consumption of some metals. Metals with high to medium depletion. Consumption of natural resources.

Theme 5.2. Soil characteristics. The problem of soil degradation

Soils, their evolution. The chemical composition of the soils. Soil pollution problems. The main pollutants and their sources.

Section 6. Pollution

Theme 6.1. The problem of chemical pollution

The notion of pollutants. Classification of pollutants. Ways of migration of pollutants in the biosphere. The chemosphere. Xenobiotics. Pollutants. Ecotoxicants. Super-ecotoxicants.

Theme 6.2. Biodegradation of pollutants

Biotransformation of pollutants. Phases of metabolism of xenobiotics (oxidation, recovery, hydrolysis and coneugation). Factors influencing the biotransformation of xenobiotics.

3. Guidelines for preparing for the introductory test

The introductory test is carried out in writing (testing). Each test contains 20 questions pertaining to different sections of the introductory test program. In preparation for the introductory test, special attention should be paid to reading the recommended literature, during which existing knowledge should be summarized and systematized. The entrance exam for the master's degree includes key and practically significant questions in the disciplines of general professional and special training.

4. An approximate list of questions and assignments of the introductory test

1. Composition, structure and characteristics of the Earth's atmosphere.
2. Chemical reactions in the atmosphere.
3. Protective functions of the atmosphere.
4. Environmental problems of atmospheric chemistry.
5. General characteristics and function of the ozone layer.
6. Acid rain.
7. The state of the air basin in the region. Protection of the atmosphere.
8. Indicators of air purity in the monitoring system.
9. Types of water pollution.
10. Clean and polluted water. Water quality indicators.
11. Water quality indicators in the environmental monitoring system.
12. Chemical methods of water purification.
13. Problems and methods of drinking water purification.
14. Soils, their evolution. Chemical composition of soils.
15. Earth resources.
16. Soil pollution problems.
17. The movement of pollutants within one environment and the transition from one environment to another.
18. Anthropogenic violations of biogeochemical cycles.
19. Migration of chemical elements.
20. The concept of the biosphere, its boundaries.
21. The concept of pollutants. Classification of pollutants. Migration routes of pollutants in the biosphere.
22. Technogenic sources of pollution of natural environments and objects.

23. Natural environmentally hazardous factors.
24. Anthropogenic violations of biogeochemical cycles.
25. Migration of chemical elements.
26. The concept of the biosphere, its boundaries.
27. The concept of pollutants. Classification of pollutants. Migration routes of pollutants in the biosphere.
28. Technogenic sources of pollution of natural environments and objects.
29. Natural environmentally hazardous factors.сред и объектов.

6. The order of the entrance test

The entrance test is carried out in the following forms:
• in the form of written blank testing;
• in the form of testing using remote technologies with mandatory identification of the applicant's personality.

The assessment scale is 100-point.
The minimum number of points confirming the successful completion of the entrance test is 40.
Working time with the test is 45 minutes.