

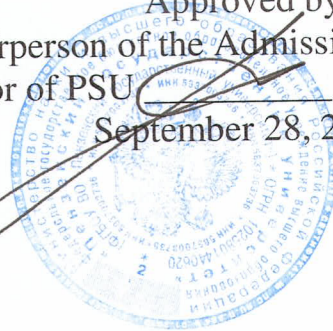


THE MINISTRY OF SCIENCE AND HIGHER EDUCATION  
OF THE RUSSIAN FEDERATION

Federal State Budgetary Educational Institution of Higher Education  
«Penza State University»  
(PENZA STATE UNIVERSITY)

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Approved by  
Chairperson of the Admission Committee,  
Rector of PSU A.D. Gulyakov  
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Programme  
of the entrance examination in the discipline  
**BIOLOGY**

Compiled by  
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## **General instructions**

To pass the biology exams applicants should demonstrate their:

### **Knowledge of:**

- basic wildlife research methods;
- main concepts, biological laws, theories, common factors, rules, hypotheses;
- essence of biological processes and phenomena;
- structure and characteristics of biological objects;
- special features of human body, its structure, life activity, higher nervous activity and behavior;
- new biology glossary and symbols;

### **Skills to:**

- explain biological theories, laws, fundamentals, hypotheses forming a new scientific worldview;
- establish relations between structure and functions of molecules, cell organs; between organs and organ systems;
- work out different tasks in cytology, genetics;
- define, compare, classify, explain biological objects and processes;
- establish relations between organisms, processes and phenomena;
- discover general and distinctive features, make conclusions;
- recognize biological objects according to their descriptions and pictures;
- apply knowledge in different situations;
- analyse and evaluate biological information;
- use achieved knowledge and skills in practice and everyday life.

## **Biology program content**

### **Biology as a science. Methods of scientific cognition**

Biology as a science, its achievements, wildlife research methods. The role, which biology plays for the new scientific worldview.

Characteristics and features of life forms: cellular textures, special characteristics of chemical compound, metabolism and energy conversion, homeostasis, irritability, reproduction, evolution.

Main levels of biological organization: cellular, organismic, population and species, holocoenotic, biospheric. Research methods.

#### **Cell as a biology system**

Modern cell theory, its fundamental principles. Cellular organisms, cell identity of all organisms is the basis of the organic world identity, demonstration of wildlife relationship.

A cell is an element of composition, life activity, growth and evolution of organisms. Cell functions and composition research methods. Variety of cells.

Chemical organization of the cell. Correlation between structure and functions of proteins, nucleic acids, ATP, carbohydrates, lipids, water – cell's composition. Genes, genetic code and its characteristics.

Structure of procaryotic and eukaryotic cells. Correlation between structure and functions of cell parts and organs is the basis of cell entirety. Chromosomes and genes. Constant number, form and size of chromosomes.

Metabolism: energy and constructive metabolism, its correlation. Enzymes, its chemical nature, role in metabolism. Matrical protein synthesis.

Photosynthesis is a process used by plants to convert light energy into chemical energy. The role of chlorophyll in absorbing and using of solar energy to modify inorganic matters into organic.

Mitosis is a process by which chromosomes in a cell nucleus are separated into two identical sets of chromosomes, each in its own nucleus. Evolution of sex cells. Meiosis. Fertilization, its kinds and importance. Similarities and differences of mitosis and meiosis processes, its importance.

#### **An organism as a biology system**

Autotrophs, chemotrophs, heterotrophs (saprotrophs, parasites, symbionts).

Viruses as acellular forms. Prevention of HIV and AIDS.

Reproduction, its importance. Ways of reproduction, similarities and differences of sexual and asexual reproduction. The role of meiosis and fertilization to ensure the constant number of chromosomes in generations.



The ontogeny and its specific common factors. Specialization of cells, formation of tissues and organs. Embryonic and postembryonic development of organisms.

Genetics, methods of its study. Genetic terminology and symbols.

Heredity laws, their cytological bases. The chromosomal theory of heredity.

Types of organisms' characters variation: modification, mutational....their reasons, their importance in organisms' life and evolution. Reaction norm.

Bad influence of mutagens, alcohol, drugs, nicotine on genes of the cell. Mutagens protection. Hereditary human diseases prevention.

Selection, its aims and tasks. Methods of new plants and animals breeding. N.I. Vavilov's study about cultivated plants origin. Homologous series law in the organisms' variation.

Biotechnologies, cellular and genetic engineering, cloning. Importance of biotechnologies for selection and national economy development, protection of nature.

### **System and variety of the organic world**

Taxonomy. Main taxonomic categories: species, genus, family, order, class, division, kingdom.

Bacteria kingdom, special features of structure and life activity of bacteria. Their role in the nature. Bacteria cause of plants, animals and human diseases. Prevention of disease caused by bacteria. Using of bacteria in biotechnologies.

Mushroom kingdom, special features of structure and life activity of mushrooms. Prevention of disease caused by mushrooms. Lichens are composite organisms.

Plant kingdom, a very various kingdom. Special features of structure and life activity of cells, tissues, organs of plants, their continuity. Vegetative and generative organs, their structure and functions.

Main characters of plants divisions, classes and families of angiosperms.

Animal kingdom, a very various kingdom. Special features of structure and life activity of cells, tissues, organs, systems of organs of animals, their correlation as the basis for continuity of a whole organism. Life activity of animals. Behavior of animals.

Main special features of unicellular and multicellular animals' sub-kingdoms, main types of multicellular animals. The most important classes and orders of invertebrate and chordates.

Evolution of plants and animals.

Growth fundamentals of cultivated plants and domestic animals. The role of plants and animals in the nature and human life. Protection of plants and animals world.

Human body and its health.

Place of a human in the world. Evolution stages of the humans. Human races, their genetic relationship. Biosocial nature of the human, social and natural environment, adaptation of the human. Human species, similarity to animals.

Special features of structure and life activity of cells, tissues, organs, systems of organs of humans: locomotive system, digestive system, respiratory system, blood circulation, discharge.

Internal environment of the human, its stability. Immunity.

Metabolism and energy transformation in the human body.

Nervous system, endocrine system. Neurohumoral regulation of body as the basis for continuity of a whole organism. Analyzers. Sense organs. Higher nervous activity. Psychics and human behavior.

Personal and social hygiene, healthy life-style. Prevention of diseases, traumatism. First medical aid. Health and risk factors. Bad habits. Mental and physical health.

Wildlife evolution

Species, its criteria. Population as a base unit of species and evolution. Origin of species.

Darwinism, theory of evolution. Synthetic theory of evolution. Natural selection, its types.

Results of evolution: adjustment of organisms to the environment, variety of animals and plants species.

Theories about archebiosis on the Earth. The organic world evolution. Directions of evolution: biological process, aromorphosis, idioadaptation, degeneration.

### **Ecosystems and their common factors**

Environments of organisms. Environment factors: abiotic, biotic. Antropogenic factor.

Ecosystem (biogeocenose), its components: biogenic elements, producers, consumers, reducers, their role in the ecosystem. Variety of ecosystems (biogeocenoses).

Variety of populations in the ecosystem, food and territory relations between them. Food chains, its elements. Plans as first elements in the food chains. Ecological pyramid rules.

Ecology of populations: their structure and dynamics. Waves of population, its reasons. Population control.

Autoregulation as the basis for ecosystem stability. Evolution of ecosystems and its change. Influence of human activity.



Circulation of elements and energy conversion in ecosystems, role of organisms from different kingdoms.

Circulation of elements and biological diversity as the basis for sustainable development of ecosystems. Conservation of biodiversity.

Agricultural ecosystems, its variety, differences between agricultural and natural ecosystems.

Biosphere as the global ecosystem. Works of Vladimir Vernadsky about biosphere, noosphere, living material, its functions, its role in the circulation of elements. Space role of plants on the Earth.

Global changes in the biosphere (expanding of ozone holes, acid rains, greenhouse effect etc.), caused by human activity. Sustainable development of biosphere.

### **Criteria for evaluating**

When applying for undergraduate and undergraduate programs the results of each entrance test are carried out on a 100-point scale. When applying for undergraduate and undergraduate programs. The results of each entrance test are carried out on a 100-point scale. The minimum number of points scored during the exam cannot be less than 36.

Author

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