MINISTRY OF SCIENCE AND HIGHER EDUCATION
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Kemerovo State University

Approved by
Director of the Institute of Biology,
Ecology, and Natural Resources
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# ENTRANCE EXAMINATION PROGRAM 2026

## for applicants of BIOLOGY (Specialists, Bachelors)

Kemerovo 2026

ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ

Сертификат: 00AAEDD5461FD53813B964A5488C8CD20B
Владелец: Просеков Александр Юрьевич
Действителен: с 18.06.2025 до 11.09.2026

The entrance examination is a test.
It lasts 2 hours (120 minutes).
The maximal score is 100 points.
Each individual version of the test has 47 tasks in various areas of Biology.

**Test structure and assessment scale**

| № | Type of test | Number of tasks | Max.score per task | Total score |
|---|---|---|---|---|
| 1 | Choose one correct answer out of four | 36 | 2 | 72 |
| 2 | Choose three coixect answers out of six | 5 | 2 | 10 |
| 3 | Match the items | 1 | 3 | 3 |
| 4 | Put the items in the correct order | 2 | 3 | 6 |
| 5 | Fill in the captions for the picture | 1 | 3 | 3 |
| 6 | Solve the problem in genetics | 1 | 3 | 3 |
| 7 | Solve the problem in molecular biology / cell biology | 1 | 3 | 3 |
| | Total | | | 100 |

Minimal threshold level — 40 points.

This Program features:
— examination test samples;
— topics;
— references.

Should you find your score disputable, you are free to file an appeal on the next day añer your test results were published on our website.

# 1. Examination test samples

1 Choose **one** correct answer

1. **Acquired immune deficiency syndrome (AIDS) in humans is caused by a:**
1) virus
2) bacteriophage
3) protozoan
4) bacterium

**2. Bacterial cells have**
1) cellulose cell wall
2) DNA in two-membrane organelles
3) ring-shaped DNA
4) large ribosomes

**3. If you cross-breed dihomozygous plants with alternative traits in phenotypes, their offspring will have the following genotype:**
1) AAbb
2) aaBb
3) AABB
4) AaBb

**4. If a person is heterozygous in eye color, how many types of gametes do they develop?**
1) one
2) two
3) three
4) four

**5. Stock-breeders use inbreeding to**
1) fix the desirable trait
2) improve the desirable trait
3) increase the number of heterozygous forms
4) select the most productive animals

**6. The modification variability limits of a trait are called**
1) genotype
2) phenotype
3) reaction norm
4) gene pool

**7. The set of genes in the offspring differs significantly from that of the parent if the type of propagation is**
1) vegetative
2) sporiparity
3) gamogenesis
4) blastogenesis

**8. Carriage of carbon dioxide in humans and most animals depends on**
1) chlorophyll
2) hemoglobin

3) enzyme
4) hormone

**9. Unlike the cells of heterotrophs, the cells of most autotrophs are associated with**
1) energy metabolism
2) protein biosynthesis
3) ATP synthesis
4) photosynthesis

**10. A constant number of chromosomes in cells is maintained during vegetative reproduction by**
1) meiotic division
2) cytoplasm movement
3) mitotic division
4) spermatogenesis

## 2 Choose **three** correct answers

**1. The refractive structures of the eye include:**
1) cornea
2) pupil
3) lens
4) vitreous body
5) retina
6) yellow spot

**2. Conditioned reflexes:**
1) are inherited
2) are species-specific
3) are individual
4) are permanent, i.e. they persist throughout life
5) facilitate survival in changing environmental conditions
6) appear in the cerebral cortex

**4. Tapeworms include:**
1) echinococcus
2) armed tapeworm
3) broad tapeworn
4) catliver fluke
5) common liver fluke
6) milk-white planarian (*Dendrocoelum lacteum*)

**5. Which of the following structural features are typical of frogs?**
1) They develop in water; the egg has no protective membranes.
2) They have skin-pulmonary respiration.
3) They develop on land only.
4) Pulmonary breathing occurs in the chest.
5) They have a three-chambered heart and two circles of blood circulation.
6) They have a four-chambered heart and two circles of blood circulation.

**6. Epithelial tissues**
1. cannot regenerate

2. contain no blood vessels
3. are responsible for secretion and absorption
4. can be either keratinized or non-keratinized
5. contain a lot of intercellular substances
6. develop all their epithelia from the ectoderm

**7. What features are typical of prokaryotic cells?**
1. They contain mitochondria.
2. The nucleoid is the carrier of hereditary information.
3. Protein synthesis occurs on mesosomes.
4. The cytoplasm contains ribosomes.
5. They reproduce by simple division.
6. They reproduce by mitosis.

## 3 Put the items in the correct order

**1. Establish the correct sequence that describes the systematic position of the Cabbage white butterfly (*Pieris brassicae*) in the animal classification. Start with the narrowest category.**
1) class: *Insecta*
2) species: *P. rapae*
3) order: *Lepidoptera*
4) phylum: *Arthropoda*
5) genus: *Pieris*
6) family: *Pieridae*

**2. Establish the correct sequence of subordination of systematic categories in plants. Start with the smallest.**
1) family: *Brassicaceae*
2) class: *Dicotyledoneae*
3) species: cabbage
4) kingdom: *plant*
5) order: *Angiosperms*
6) genus: *Brassica*

**3. Put the stages of protein synthesis in the correct order:**
1) Amino acids are transferred to the ribosome;
2) Transcription;
3) mRNA is transferred from the nucleus to the cytoplasm;
4) Peptide bond develops between amino acids;
5) mRNA attaches to the ribosome

## 4 Match the items

**1. Match the cell organoid and its description:**

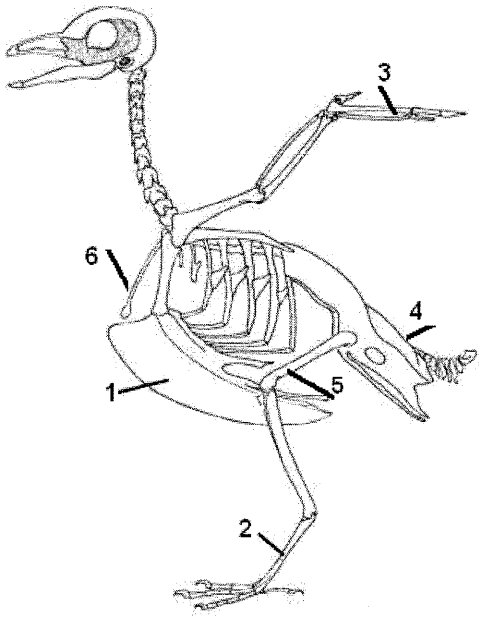
| Description | Organoid |
|---|---|
| A. has a single membrane;<br>B. has a double membrane;<br>C. has thylakoids and grana in the stroma;<br>G. contains enzymes for the breakdown of proteins, fats, carbohydrates, and nucleic acids;<br>D. contains enzymes for the synthesis of glucose, fats, and amino acids; | 1. Chloroplast<br>2. Lysosome |

| | |
|---|---|
| E. is formed by separation from the Golgi organ | |

**2. Match the tissue and its description:**

| Description | Tissue |
|---|---|
| A. Cells have no striations;<br>B. Cells contract following the impulses of the autonomic nervous system;<br>B. Fibers contract following the impulses from the somatic nervous system;<br>D. The cell contains one nucleus;<br>D. The tissue forms skeletal muscles;<br>E. The tissue forms a muscular layer of blood vessels | 1. Smooth muscle<br>2. Striated muscle |

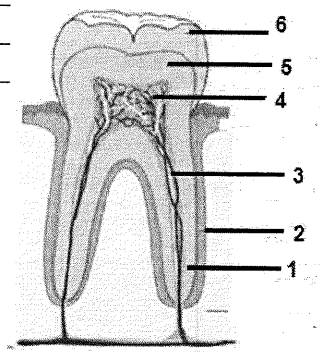
## 5 Fill in the captions for the picture




**1. Match the parts of the pigeon skeleton (a-f) and captions 1-6:**

a) metacarpus
b) synsacrum
c) tarsometatarsus
d) femur
e) keel
f) furcula

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Bones** | | | | | | |




**2. Match the tooth parts (a-f) and captions 1-6:**

a) dental enamel
b) root
c) dentine
d) periodont (dental ligament)
e) tooth pulp
f) root canal

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Tooth parts** | | | | | | |

## 6 Solve the problem in genetics

1. Diheterozygous male fruit flies with a gray body and normal wings (dominant traits) were crossed with females with a black body and short wings (recessive traits). The dominant and recessive genes for these traits were linked pairwise. No crossover happened during the germ cell formation. Determine the genotypes of the parents and the possible genotypes and phenotypes of the $F_1$ offspring. Draw a scheme.

2. A form of anemia is inherited as an autosomal dominant trait. In homozygotes, this disease is fatal; in heterozygotes, it manifests itself in a mild form. A woman with normal eyesight and a mild anemia gave birth to two sons from a color-blind man with no anemia. The first son suffers from a mild anemia and color blindness, while the second son is completely healthy. Determine the genotypes of the parents and children.

3. In sheep, long ears do not completely dominate earlessness. Short ears are an intermediate feature. Black fur dominates white coat. A long-eared black ewe, heterozygous for the second trait, was crossed with a short-eared white ram. Determine the genotypes of the parents and possible genotypes and phenotypes of the offspring.

4. Blood type and Rh rhesus are autosomal unlinked traits.

Three alleles of one gene ($i^0$, $I^A$, $I^B$) control the blood group. The alleles $I^A$ and $I^B$ dominate the $i^0$ allele. The recessive $i^0$ allele determines blood type 0; the dominant $I^A$ allele determines the blood type A, the dominant $I^B$ allele determines the blood type B, and two dominant alleles $I^AI^B$ determine the blood type AB. Positive Rh rhesus (R) dominates negative Rh rhesus (r).

The father has blood type B and positive Rh (diheterozygote); the mother has blood type A and positive Rh (dihomozygote). Determine their genotypes. What blood group and Rh factor will their children have? What are their possible genotypes and phenotype ratio? Draw a scheme.

## 7 Solve the problem in molecular biology / cell biology

1. Larch needle pulp cells contain 24 chromosomes. What chromosome set is typical for wood and ovule cells? From which cells and as a result of what division do they form? Explain your answer.

2. Define the chromosome set and the number of DNA molecules at the stage of prophase of meiosis I and the stage of anaphase of meiosis II. Explain your answer.

3. Drosophila somatic cells contain 8 chromosomes. Define the chromosome set and the number of DNA molecules during oogenesis at the stage of telophase of meiosis I and anaphase of meiosis II. Explain your answer.

4. What chromosome set do fern prothalus and spores have? From which cells and as a result of what division do they form? Explain your answer.

## 2. Topics

**Biology as a life science. Methods of biology.**

The role of Biology in agriculture, industry, medicine, hygiene, and nature conservation. Cognition methods that are used to study living nature.

Living systems: cell, organism, species, biocenosis, biosphere, and evolution. Signs of living systems: metabolism, energy, integrity, interconnection of structure and functions, connection with the environment, and self-regulation.

The role of Biology in developing the scientific worldview and personality culture.

General biological patterns. Molecular, cellular, organismal, population-species, biogeocenotic, and biospheric levels of organization of living nature.

**The cell as a biological system.**

Cell theory. Methods of cell study. The cell as a structural and functional unit of living organisms. The chemical composition of cells and their similarity in different organisms as the basis of the unity of living nature. Inorganic substances: water, mineral salts. The structure of organic substances: carbohydrates, lipids, nucleic acids, ATP and their functions. Enzymes and their role in the cell.

The parts and organelles of the cell: their structure, functions, relationship as the basis of its integrity. Cell types. Viruses: non-cellular form, pathogens. Preventing HIV and AIDS. Cellular metabolism. Energy exchange. Energy transformation in the cell. The role of ATP. Constructive metabolism. Protein biosynthesis. Gene. Genetic code. Matrix nature of biosynthetic reactions. Photosynthesis. Chemosynthesis. Plastic metabolism vs. energy metabolism.

**The organism as a biological system. Reproduction and individual development of organisms.**

Diversity of organisms: unicellular and multicellular organisms, autotrophic and heterotrophic organisms, prokaryotes and eukaryotes. Structural elements of the body: cells, tissues, organs, and organ systems.

The cell as the genetic unit of living things. Somatic and reproductive cells. Chromosomes: autosomes and biological sex. Homologous and non-homologous chromosomes. The number and shape of chromosomes. How cell prepare for division. DNA reduplication as the basis for chromosome duplication.

Mitosis and its significance. The development of reproductive cells. Meiosis. Cell specialization and tissue formation.

Self-reproduction as the most important sign of living things. Reproduction, sexual and asexual propagation. Fertilization.

Ontogenesis. Embryonic and postembryonic development: direct and indirect. The development of the embryo in animals. The harmful effects of alcohol and nicotine on the human development.

**System and diversity of the organic world**

Diversity of organisms. The main systematic (taxonomic) categories: kingdom, phylum, class, order, family, genus, species, and their subordination. Viruses are non-cellular life forms. Measures to prevent viral diseases.

Bacteria. The structure and activity of bacteria, their reproduction. Distribution through air, soil, water, and living organisms. Its role in nature, industry, medicine, and agriculture. Pathogenic bacteria and their control.

Fungi. General characteristics of the fungi kingdom. Structure, life activity, reproduction. Variety of fungi. The role of fungi and mushrooms in nature and human life. Symbiosis of fungus and algae. Lichens: structure, diversity, features. The role of lichens in nature and human life.

Plants. Types of plants. General characteristics.

Plants as organisms. Relationships between cells, tissues, and organs. Basic life processes. Life cycle of plants. Gametophyte and sporophyte.

Algae. Structure and activity of unicellular and multicellular algae. The role of algae in nature and the national economy.

Higher spore plants: Bryophytes, Ferns, Horsetails, and Lycopsoid. Their structure, reproduction, features, diversity. Their role in nature and human life.

Gymnosperms. Structure and reproduction (pine, spruce, and other conifers). Their reproduction and role in nature and national economy.

Angiosperms. Their structure and peculiarities as the most highly organized group of plants, their dominance on Earth. Varieties.

Dicotyledons. Families: *Cruciferous (Cabbage), Rosaceae, Legumes, Nightshade, Compositae (aster)*. Class: Monocot plants. Families: lily, cereals. Their biological features and role in national economy.

Effect of human activity on the species diversity of angiosperms. Preservation and restoration of rare plant species.

The most important agricultural plants (cereals, fruits and berries, vegetables, oilseeds, industrial plants, etc.), biological bases and cultivation technologies. Origin of cultivated plants. The concept of variety (cultivar). Scientific achievements in breeding new plant varieties.

Animals. Diversity of the animal world. The main differences between animals and plants, their similarities. Systematics of animals.

Unicellular as the most primitive and ancient animals. Common venous amoeba. Structure of a unicellular organism. The variety of unicellular animals, their role in nature and human life. General characteristics.

Multicellular animals. Types, structure, reproduction. Coelenterates. Flatworms. Roundworms. Ringed worms. Shellfish.

Arthropods. Structure, reproduction. General characteristics of classes. Crustaceans. Arachnids (spiders and mites). Insects. Major orders of insects. The diversity of insects and their role in nature; practical and aesthetic value. Biological way to control insect pests of agricultural crops and its role in preserving the crop. Insect protection.

Chordates. General characteristics. Classes, structure, reproduction. Their role in nature and human life. Lancelet. Cartilaginous and bony fishes. Amphibians. Reptiles. Birds. Mammals. Orders of placental animals.

**Human health**

Structure of human body. The role of knowledge about the structure, life, and hygiene of human body for health protection.

Organs and organ systems.

Musculoskeletal system. The role of the musculoskeletal system. First aid for bruises, sprains, dislocations, and fractures.

Muscles and their functions. The main muscle groups of the human body.

Blood and circulation. Immunity. Ilya I. Mechnikov and the doctrine of immunity. Infectious diseases and their control. Blood groups. Blood transfusion. Donation. Preventive vaccinations. Preventing HIV and AIDS.

Circulatory organs. Heart and blood vessels (arteries, capillaries, veins).

Preventing cardiovascular diseases. First aid for bleeding. The harmful effects of smoking and drinking alcohol on the heart and blood vessels.

Breathing. The role of respiratory system. Infectious diseases transmitted by airborne droplets, prevention of airborne infections, hygiene regimen during illness. Respiratory hygiene.

The harmful effects of smoking. Digestion. Its role and regulation of digestive processes. Hygienic conditions for normal digestion.

Preventing helminthic and gastrointestinal diseases, food poisoning; first aid. Effects of smoking and alcohol on digestion.

Metabolism and energy. General characteristics. Effect of alcohol, toxic substances, and drugs on metabolism. Vitamins. Their role in metabolism. Major hypovitaminosis. Hypervitaminosis.

Ways to preserve vitamins in foods. Nutrition standards. Balanced diet.

Secretion. Organs of the urinary system, their functions, and urinary disease prevention.

Skin. Structure, functions, and role in thermoregulation.

Developing resistance to the cold. Skin hygiene; hygiene requirements for clothing and footwear. Heatstroke, sunstroke, burns, frostbite, electric shock: prevention and first aid.

Endocrine glands. The value of the endocrine glands for growth, development, regulation of body functions. Hormones. The role of the gonads in the development of the body. Puberty. Hygiene rules for young men and women.

Nervous system. Sense organs. Higher nervous activity. The value of the nervous system in the regulation and coordination of the human body, its functions, and environment. Higher nervous activity in humans. Speech and thinking. Sense organs. Consciousness as a function of the brain. Social conditioning of human behavior.

The role of Ivan M. Sechenov and Ivan P. Pavlov in higher nervous activity studies.

Sleep, its meaning and hygiene. Working capacity during the day. Hygiene of mental work. The harmful effects of nicotine, alcohol, and drugs on the nervous system.

Basic genetics. Genetics as the science of heredity and variation in organisms. Basic methods of genetics. Mono- and dihybrid cross-breeding. Offspring analysis. Heredity and variability as properties of the organism. Methods for studying heredity and variability of plants, animals, and humans. Gregor Mendel and the laws of

inheritance. Dominant and recessive traits. Allelic genes. Phenotype and genotype. Homozygous and heterozygous. Uniformity of the first generation.

Intermediate nature of inheritance. The law of segregation. Statistical nature of segregation. Cytological bases of uniformity of the first generation and segregation in the second generation. The law of independent inheritance and its cytological foundations.

Thomas Morgan's law of genetic linkage, its cytological foundations. Complete and incomplete linkage. The role of chromosome crossing.

Genotype as an integral historical system. Sex genetics. Chromosomal theory of heredity. The role of genetics in medicine and public health. The harmful effects of nicotine, alcohol, and drugs on human heredity.

The role of the genotype and environmental conditions in phenotype development. modification variability. Reaction norm. Statistical patterns of codification variability.

Mutations and their causes. Nikolai I. Vavilov's law of homological series in hereditary variability. Experimental mutations. Mutations as material for artificial and natural selection. Measures to protect against contamination by mutagens. The importance of genetics for the prevention of hereditary diseases in humans.

**Selection basics**

Genetics as the theoretical basis of selection. The contribution of Nikolai I. Vavilov to the development of breeding: the doctrine of the centers of origin and diversity of cultivated plants. Selection methods: hybridization, artificial selection, mutagenesis, polyploidy, and heterosis.

Plant selection. Self-pollination of cross-pollinated plants. Heterosis. Polyploidy and distant hybridization.

Animal selection. Types of crossing and breeding methods.

Method for the analysis of hereditary economically valuable traits in breeding animals. Remote hybridization of domestic animals.

Biotechnology: microbiological synthesis, genetic and cell engineering, their role in the development of the national economy and nature conservation.

Superorganism systems. Ecology. Evolution

Type and criteria. Population as a structural unit of a species. The number of individuals, age and sex composition, population sizes, forms of coexistence of individuals.

Plant community. Ecological factors of inanimate and living nature associated with human activities. The relationship of plants and the factor of inanimate and animate nature as in the case of plants in the forest, meadow, etc. Adaptability of plants in their coexistence in the forest, meadow, etc. The role of plants in nature and human life. The impact of human activity on plant life. Protection of plants and plant habitat, laws of environmental protection.

The development of the plant world. Variety of plants and their origin. Evidence of the historical development of plants.

The main stages in the development of the plant world: development of unicellular and multicellular algae; photosynthesis; development of land plants (psilo-

phytes, mosses, ferns, gymnosperms, angiosperms). Development of complex plants. Phylogenetic relationships in the plant kingdom.

The dominance of angiosperms at the present time, their diversity and distribution on the globe. The impact of human economic activity on the plant world. Conservation of biological diversity of plants.

The evolution of the animal world. Evidence of the historical development of the animal world: comparative anatomical, embryological, paleontological.

Origin of unicellular organisms. Origin of multicellular organisms. Development of complex vertebrates in the process of historical development of the animal world. Relationship between humans and animals.

Evidence for the evolution of wildlife. Charles Darwin's doctrine of evolution. Natural selection as the guiding factor of evolution. Adaptability and its relative nature. Driving and stabilizing selection.

Artificial selection and hereditary variability as the basis for the farm breeding. The concept of plant varieties and animal breeds.

Microevolution. Speciation Modern concepts. Biological progress and regress. Correlation of different directions of evolution. Basic laws of evolution. The results of evolution.

Origin of life on earth. Development of the organic world in the Archean, Proterozoic, Paleozoic, Mesozoic, and Cenozoic eras. The main aromorphoses in the evolution of plants and animals.

Anthropogenesis. Evidence for the animal origin of humans. Driving forces of anthropogenesis: social and biological factors. Stages of human evolution. Evidence of the unity of the human races. Criticism of racism and social Darwinism.

Ecosystems. Ecosystem and biogeocenosis. The structure of the ecosystem. Dominant and rare species, their role in the ecosystem. The concept of habitat. Environmental factors: abiotic, biotic, and anthropogenic. Optimum laws. Abiotic factors and adaptability of organisms. Biological rhythms. Photoperiodism. Intraspecific and interspecific relationships: predation, competition, parasitism, symbiosis. Anthropogenic factors. Diversity of populations in the ecosystem genetic and trophic interconnections. Producers, decomposers, and consumers. Food chains and webs.

Ecosystems. The cycle of matter and the energy transformation. Ecological pyramid rules. Self-regulation is the basis of ecosystem sustainability. Population fluctuations in ecosystems. Changes in ecosystems. Reasons for changing ecosystems: external (natural anthropogenic) and internal.

Agroecosystems, their diversity, differences from natural ecosystems. Conservation of biological diversity as a basis for sustainable development of ecosystems.

The biosphere as a global ecosystem. Vladimir I. Vernadsky's contribution to the biosphere doctrine. The role of living matter in the biosphere. The distribution of biomass. Biological cycle. Biogenic migration of atoms. Evolution of the biosphere. Man-induced global changes in the biosphere. Sustainable development of the biosphere.

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