

Ministry of Science and Higher Education of Russian Federation
Federal State Budgetary Educational Institution of Higher Education
«Pitirim Sorokin Syktyvkar State University»
(FSBEI HE «SyktSU»)

The Program of the Entrance Tests in Biology
for the Students entering Bachelor and Specialist Programmes

Syktyvkar – 2021

THE LIST OF BASIC TERMS AND BASIC QUESTIONS

Biology as a scientific discipline. Methods of the scientific research

1. Biology as the science, methods of scientific research of the nature. What Biology contributes to the Modern Scientific Worldview.

2. Biological Organization and Evolution. Basic Levels of the Biological Organization: Cell, Organism, Population, Biocoenosis or Community, Biosphere. Biological systems. The common features of the biological systems: cellular structure, chemical composition features, metabolism and conversion of energy, homeostasis, irritability, movement, growth and development, reproduction, evolution.

Cell as a biological system

1. Modern Cell Theory, basic conceptions of the Cell Theory, what the Cell Theory contributed to the modern scientific worldview. The development of knowledge about the cell. Cell structure organisms - the similarity of the structure of cells of all organisms is the basis of the unity of the organic world, evidence of the kinship of wildlife.

2. Cell diversity. Prokaryotic and eukaryotic cells. Similarities and differences between plant, animal, bacteria, and mushroom cells.

3. Chemical composition of a Cell. Macro- and Micro-element. Interconnection of the structure and function of the organic and non-organic elements (proteins, nucleic acids, lipids, carbohydrates, ATF) in the cell's structure.

4. Cell structure. Interconnection of the structure and function of the cell's elements and organelles of cell as a key element of cell integrity.

5. Metabolism and the transformation as the properties of living organisms. Anabolism and Catabolism and interaction between them. Stage of Metabolism. Fermentation and Cellular Respiration. Photosynthesis, its significance, the role of Photosynthesis in the Universe. Stages of Photosynthesis. Light-dependent and Light-independent reactions and their interaction. Chemosynthesis. The role of the Chemosynthetic Bacteria on Earth.

6. Genetic information in Cell. Gene, Genetic code and its characteristics. Matrix characteristics of Biosynthesis' reactions. Biosynthesis of Proteins and Nucleic Acids.

7. Cell as a genetic unit of all organisms. Chromosomes, composition of Chromosomes (shape and size) and its functions. The number of chromosomes and their species permanent. Somatic cell and Gametes. Cellular process: Interphase and Mitosis. Mitosis and the division of somatic cells. Meiosis. Phase of Mitosis and Meiosis. The development of Gametes in Plants and Animals. Cell division as a base

for growth, development and reproduction. Function of Meiosis and Mitosis.

Organisms ad a biological system

1. A variety of organisms: unicellular and multicellular; autotrophs, heterotrophs. Viruses are non-cellular life forms.

2. Reproduction of organisms, its significance. Methods of reproduction, the similarity and difference between sexual and asexual reproduction. Fertilization mechanisms in flowering plants and vertebrates. External and internal fertilization.

3. Ontogenesis and the regularities of ontogenesis. Embryonic and postembryonic development of organisms. Basic causes of the impaired development of organism.

4. Genetics and its aim. The Heredity and variability are the properties of organisms. Genetics methods. Basic genetic concepts, symbols. Chromosome theory of Heredity. Modern ideas of Gene and Genome.

5. Patterns of heredity and cytological basis of heredity. Mendelian genetics and cytological basis of it (monohybrid- and dihybrid crosses). Thomas Hunt Morgan's law: genetic linkage, impaired genetic linkage. Genetic of sex. Inheritance of sex-linked traits. Gene interactions. Genotype as a system. Human genetics. Methods of studying human genetics. Solution of genetic tasks. Drawing up cross breeding patterns.

6. Genetic variability. Phenotypic plasticity. Reaction norm. Genetic variation: mutation and recombination. Types of mutation and its causation. Role of variability in the evolution process and in the life of organisms.

7. Genetics and medicine. Common genetic disorders, types, symptoms, causes. The harmful effects of mutagens, alcohol, drugs, nicotine on the genetic apparatus of the cell. Protecting the environment from mutagen contamination. Identification of sources of mutagens in the environment (indirectly) and assessment of the possible consequences of their impact on their own body.

8. Breeding, its tasks and practical significance. Nikolay I. Vavilov and development of breeding: idea of centers of origin of cultivated plants; the law of homologous series in hereditary variation. Methods of breeding and its genetic foundation. Methods of breeding new varieties of plants, animal breeds, strains of microorganisms. The importance of genetics for selection. Biological basis for the cultivation of cultivated plants and domestic animals.

9. Biotechnology, types of biotechnology. Cell and genetic engineering, cloning. The role of cell theory in the formation and development of biotechnology. The importance of biotechnology for the development of breeding, agriculture, the microbiological industry, the conservation of the planet's gene pool. Ethical aspects of

some research in biotechnology (human cloning, directed genome changes).

System and diversity of the organic world

1. The diversity of organisms. Carl Linnaeus and Jean-Baptiste Lamarck. The main systematic (taxonomic) categories: species, genus, family, order (order), class, phylum, kingdom; their subordination.

2. Bacteria, structure, life, reproduction, role in nature. Bacteria - pathogens of diseases of plants, animals, humans. Prevention of diseases caused by bacteria.

3. Fungus, structure, livelihoods, reproduction. The use of mushrooms for food and medicine. Recognition of edible and poisonous mushrooms. Lichens, their diversity, structural features and vital functions. Role in the nature of fungi and lichens.

4. Plants. The structure (tissues, cells, organs), vital activity and reproduction of the plant organism (for example, angiosperms). Recognition (in the figures) of plant organs.

5. The variety of plants. The main division of plants. Classes of angiosperms (flowering plants), the role of plants in nature and human life.

6. Animals. Protozoa and Metazoa. Characterization of the main types of invertebrates, arthropod classes. Features of the structure, life, reproduction, the role in nature and human life.

7. Chordate. Description of the main classes. Role in nature and human life. Recognition (in the figures) of organs and organ systems in animals.

Human body, human health.

1. Tissues. The structure and vital functions of organs and organ systems: digestion, respiration, excretion. Recognition (in the figures) of tissues, organs, organ systems.

2. The structure and vital functions of organs and organ systems: musculoskeletal, integumentary, blood circulation, lymph circulation. Reproduction and human development. Recognition (in the figures) of organs and organ systems.

3. The internal environment of the human body. Blood types. Blood transfusion. Immunity. Metabolism and the conversion of energy in the human body. Vitamins.

4. Nervous and endocrine systems. Neurohumoral regulation of the body's vital processes as the basis of its integrity, communication with the environment.

5. Analyzers. Sense organs, their role in the body. The structure and functions. Higher nervous activity. Sleep, its meaning. Consciousness, memory, emotions, speech, thinking. Features of the human psyche.

6. Personal and social hygiene, a healthy lifestyle. Prevention of infectious

diseases (viral, bacterial, fungal, caused by animals). Injury prevention, first aid techniques. Mental and physical health of a person. Health factors (auto- training, hardening, physical activity). Risk factors (stress, lack of exercise, overwork, hypothermia). Bad and healthy habits. Dependence of human health on the state of the environment. Compliance with sanitary standards and rules of a healthy lifestyle. Reproductive human health. The effects of alcohol, nicotine, narcotic substances on the development of the human embryo.

Nature evolution

1. Species, its criteria. A population is a structural unit of a species and an elementary unit of evolution. Microevolution. The formation of new species. Methods of speciation.

2. The development of evolutionary ideas. The value of the evolutionary theory of Charles Darwin. The relationship of the driving forces of evolution. Forms of natural selection, types of struggle for existence. Synthetic theory of evolution. Elementary factors of evolution. The role of evolutionary theory in the formation of the modern scientific natural worldview.

3. Evidence of the evolution of nature. The results of evolution: the adaptability of organisms to the environment, the diversity of species.

4. Macroevolution. Directions and paths of evolution (A.N. Severtsov, I.I. Shmalgauzen). Biological progress and regression, aromorphosis, idioadaptation, degeneration. Causes of biological progress and regression. Hypotheses of the origin of life on Earth. The main aromorphoses in the evolution of plants and animals. The complication of living organisms in the process of evolution.

5. Human evolution and origin of human. Human as a species, his place in the system of the organic world. Hypothesis of human origin. Driving forces and stages of human evolution. Human races, their genetic kinship. The biosocial nature of man. Social and natural environment, human adaptation.

Ecosystems and their inherent patterns

1. The habitat of organisms. Environmental factors: abiotic, biotic, their significance. Anthropogenic factor.

2. Ecosystem (biogeocenosis), its components: producers, consumers, reducers, their role. Species and spatial structure of the ecosystem. Trophic levels. Chains and power networks, their links. The rules of the ecological pyramid. Drawing up schemes for the transfer of substances and energy (circuits and power networks).

3. The diversity of ecosystems (biogeocenoses). Self-development and change of ecosystems. Sustainability and dynamics of ecosystems. Biological diversity, self-regulation and the circulation of substances are the basis for the

sustainable development of ecosystems. Causes of sustainability and ecosystem change. Changes in ecosystems under the influence of human activities. Agroecosystems, the main differences from natural ecosystems.

4. Biosphere - a global ecosystem. V.I. Vernadsky theory about the biosphere. Living matter, its functions. Features of the distribution of biomass on Earth. The biological cycle of substances and the conversion of energy in the biosphere, the role of organisms of different kingdoms in it. The evolution of the biosphere.

5. Global changes in the biosphere caused by human activities (violation of the ozone screen, acid rain, greenhouse effect, etc.). Problems of sustainable development of the biosphere. Preservation of the diversity of species as the basis for the stability of the biosphere. Rules of conduct in the natural environment.

EVALUATION CRITERIA

The entrance test is carried out in writing in the form of a test. It is possible to conduct an entrance test using distance technologies when testing an applicant.

The entrance test lasts 60 minutes.

The maximum number of examination points is 100, the minimum is 39.