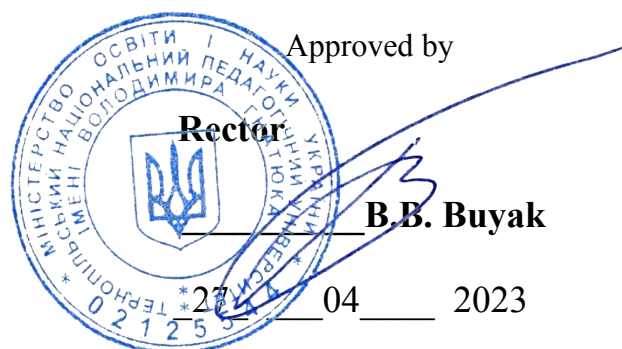


**MINISTRY OF EDUCATION AND SCIENCE
OF UKRAINE**

**TERNOPIL VOLODYMYR HNATIUK NATIONAL PEDAGOGICAL
UNIVERSITY**

CHEMISTRY AND BIOLOGY FACULTY



PROGRAM

**OF PROFESSIONAL ENTRANCE EXAMINATION
QUALIFICATION 014.05 SECONDARY EDUCATION
(BIOLOGY)**

for admission to study for a **bachelor's degree**
(for applicants on the basis of complete general secondary education)

TERNOPIL-2023

Explanatory note

Biological education should contribute to the cultural awareness of a personality who realizes his/her own responsibility to society for the preservation of life on Earth, the formation of ecological culture, the strengthening of mental and physical health of each individual and society.

The goal of biological education is achieved by studying the subject of “Biology”, functioning to develop applicants’ key skills and competencies required in modern life.

The subject of “Biology” involves the development of entrants’ holistic idea of modern nature and science, the role of mankind in the world.

The task of the subject “Biology” covers:

- development of knowledge about the principles of functioning and structure of biological systems, their onto- and phylo-genesis, the relationship between biological systems, the environment; mastering the methodology of scientific knowledge;
- development of skills necessary to establish a harmonious relationship with nature on the basis of respect for life as the highest value and all living beings as a unique part of the biosphere;
- promotion of a healthy lifestyle, including: the notion of health, forms and ways of its formation, preservation and strengthening, the importance of elements comprising healthy lifestyle;
- formation of skills to apply theoretical knowledge in order to land a professional career in the applied spheres of human activity (medicine, agro-industrial complex, industry, biotechnology, pharmacology, psychology, pedagogy, etc.);
- development of mental abilities and qualities of the individual (cognitive interest, observation, imagination, attention, memory, theoretical style of thinking), desire for self-education, self-knowledge, self-improvement, self-realization in various activities;
- mastering a decision-making process, free choice and action in the spheres of life, where the problems of man as a living being, society and the environment overlap;
- formation of scientific worldview; formation of emotional and valuable attitude to nature, to oneself, to people, to universal values and virtues.

The educational material, taking into account the integrity and systemic character of wildlife, is arranged on a basis of a linear-concentric principle and is generated around the content lines, which are based on the levels of organization of life:

- molecules and cells;
- organisms;
- above organisms: population and community;
- diversity of the organic world; evolution;
- methods of scientific research.

The main content elements of the educational subject are biological ideas and theoretical generalizations, which are important components of universal culture: the levels of organization of wildlife, the connection of structure and functions of organisms, historical development of the organic world, diversity of organisms, ecological patterns, integrity and self-regulation link between man and nature. The

structuring of educational material around these biological ideas forms the core of the educational subject, which promotes the integration of individual knowledge into the system, ensures their integration and thus facilitates the understanding of educational material, eliminates the need to memorize large amounts of knowledge, and promotes theoretical thinking.

Systemic, structural and functional approaches are used in the design of the content of biological education. This makes it possible to pay more attention to the study of the processes of life of organisms, thus reducing morphological and anatomical information about them. In addition, the application of a functional approach ensures the formation of the idea of the body as a holistic system, and focuses students on a healthy lifestyle.

The content of the topics is in line with the State Standard for Basic and Complete Secondary Education. Each topic of the program provides mandatory learning results: requirements for knowledge and skills of applicants, which can be expressed in different types of educational activities (intellectual, practical, etc.). From each topic, the entrant must know, and therefore name, give examples, explain, justify, define, compare, apply knowledge, draw conclusions, follow the rules of safety, rules of conduct in nature, and so on. Comparing the results of the entrant's educational activities with the basic requirements for knowledge and skills outlined in the framework, the educator has the opportunity to determine the level of academic achievement of entrants and evaluate them.

Biology is the science of wildlife.

The importance of biology for human life.

Variety of living organisms, their habitats, classification. Research of biological objects.

Section I. Molecular level of organization of life

A short historical account of the development of biological studies. Methods of biological research. Levels of organization of living matter. The concept of "life": its essence and elements.

Inorganic substances

Elemental composition of living organisms. Inorganic substances: water and mineral salts.

Organic substances

Small organic molecules (lipids, monosaccharides, amino acids, nucleotides); macromolecules (polysaccharides, proteins, nucleic acids), their structure, properties, functions. Systemic character of chemical structure of organisms.

Section II. Cellular level of organization of life

Cell

Historical account of cell studies. Methods of cytological research. The structure of prokaryotic cells and eukaryotes. Cell membranes. Cell surface apparatus – a system for obtaining information from the external environment, its functions. Core – system of preservation of hereditary information. The structure of the core. Core functions. Nucleoid of prokaryotic cells.

Cytoplasm, its components

Cytosol, ribosomes. Protein synthesis. Cytoskeleton. Cell center.

Single-membrane organelles: endoplasmic mesh, Golgi apparatus, lysosomes, vacuoles. Bilingual organelles: mitochondria and the process of respiration, plastids and the process of photosynthesis.

Cell as a holistic system

Cell cycle. Mitosis. Meiosis. Cariotip. Exchange of substances and energy in the cell. Modern cell theory. Cytotechnology.

Section III. Non-cellular life forms

Viruses, prions. Structure, life cycles. Their role in nature and human life.

Section IV. Organisms

Bacteria

General characteristics of bacteria. Their varieties. Significance in nature and in human life.

Plants

The main functions of the plant organisms

Characteristics of plants. Plant viability. Plant nourishment. Photosynthesis. Respiration in plants. Evaporation of water by plants. Plant movements. Conditions necessary to ensure plant life.

Plant structure

Cells, tissues and organs of plants. Vegetative organs: root, shoots. Components of the shoot: stem, leaf, bud. The main functions of plant organs. The plant as a holistic organism.

Reproduction and development of plants

Asexual reproduction. Sexual reproduction. Structure and variety of flowers. Inflorescence. Pollination, fertilization. Seed and fruit, their structure. Influence of environmental conditions on seed germination. Growth and development of plants.

Plant variety

Algae

General characteristics of algae. Habitats. Adaptive features of the structure and functioning of algae. Variety of algae, their importance for nature and human life.

Spore plants (higher cryptogams)

General characteristics of spore plants. Mosses, lycophytes, horsetails, ferns. Habitats. Adaptive features of structure and life processes. The importance of higher spore plants for nature and human life.

The gymnosperms

General characteristics of the gymnosperms. Habitat. Adaptive features of the structure and functioning of the gymnosperms. Variety of gymnosperm plants. Significance for nature and human life.

The angiosperms

General characteristics. Classification of angiosperms. Characteristics of classes and individual families. The role of angiosperms in nature and human life. Agricultural, medicinal, ornamental plants.

Fungi

Fungi and lichen

General characteristics of fungi. Variety of mushrooms. Distribution, habitat. Adaptive features of structure and life. Lichens. The importance of fungi and lichens for nature and human life.

Organisms and habitats

Habitat and its factors. Settlement of plants in nature. Ecological groups of plants. Vital forms. Interaction of plants, fungi, bacteria and their role in ecosystems. Modern ideas about the historical development of bacteria, fungi, plants. Nature protection.

Section V. Animals

Zoology is a science that studies animals

The animal world is part of nature. Variety of animals and their classification. The role of animals in human life.

Anatomy, physiology and life of animals

Organization of the animal body. Features of the animal cell structure. Tissues, organs and systems of animal organs, their functions. The main manifestations of animal life. Habitats of animals. Animal behavior. A variety of animal lifestyles. Animal connections with other components of ecosystems.

Animal variety

Unicellular

General characteristics and diversity of the unicellular organisms - inhabitants of freshwater bodies (ameba proteus, euglena green, Paramecium caudatum), seas (foraminifera and radiolaria) and soil. Parasitic protozoa (dysenteric amoeba, malaria plasmodium, etc.). The role of the unicellular in ecosystems and their importance for humans.

The multicellular. Diploblastic animals

General characteristics and variety of multicellular animals.

Porifera. General characteristics, role in nature and significance for humans.

Coelenterata. General characteristics and variety of coelenterates. The role of coelenterates in ecosystems and human importance. Protection of sponges and coelenterates.

Triploblastic Animals. Worms

Flatworms. General characteristics and variety of flatworms. Roundworms. General characteristics, diversity. Ringed worms. General characteristics, diversity. The

role of worms in ecosystems. Value for humans.

The Arthropoda

General characteristics of Arthropods.

The Crustaceans. General characteristics of the class. Variety of Crustaceans. Role of Crustaceans in the ecosystems and humans.

The Arachnida. General characteristics of the class. Variety of arachnids and their role in ecosystems. Value for human life.

Insects. General characteristics of the class. Features of development. Insect behavior. Variety of insects. The role of insects in ecosystems, their importance to humans.

Protection of arthropods.

Mollusca

General characteristics, variety of mollusks. The role of mollusks in ecosystems, their importance to humans.

The Chordata. Acrania. Fishes

General characteristics of the class. Acrania. General characteristics.

General characteristics of the Vertebrates. Cartilaginous fishes. General characteristics of the class, peculiarities of life processes, behavior, diversity of Cartilaginous fishes. Role in ecosystems and economic importance of Cartilaginous fishes.

Osteichthyes. General characteristics of the class, peculiarities of life processes. Behavior and seasonal phenomena in the life of fish. Variety of bony fishes. Role in aquatic ecosystems. The importance of fish for human life. Fisheries. Fish protection.

The Amphibia

General characteristics of the class. Peculiarities of life processes and behavior. Seasonal phenomena in the life of amphibians. Variety of amphibians.

The role of amphibians in ecosystems, their importance to humans. Protection of amphibians.

Reptilia

General characteristics of the class of reptiles. Peculiarities of life processes and behavior. Seasonal phenomena in the life of reptiles. Variety of reptiles. The role of reptiles in ecosystems, their importance for humans. Protection of reptiles.

Birds

General characteristics of the class. Peculiarities of bird life. Features of adaptation to flight and different environments. Variety of birds. Reproduction and development of birds.

Seasonal phenomena in the life of birds. Behavior of birds: nesting, mating and courtship, care for the offspring. Bird flights. The role of birds in ecosystems, their importance to humans. Bird protection. Poultry farming.

Mammals

General characteristics of the class of mammals. Peculiarities of life processes. Variety of mammals. Seasonal phenomena in the life of mammals, their behavior. The role of mammals in ecosystems, their importance to humans. Protection of mammals. Cattle farming.

Organisms and habitats

Influence of environmental factors on animals. Ethical attitude of humans to other animal species. Human relations with other animal species.

Animal protection. Red Book of Ukraine. Protected areas. The main stages of historical development of the animal world.

Section VI. Human

Biological sciences that study the human body. The importance of knowledge about humans to maintain their health. Origin of human. Features of Homo sapiens. Social and cultural heritage.

The human body as a biological system

The concept of biological systems. Cellular structure of the human body. Characteristics of tissues. Organs. Physiological systems of human organs. Regulatory systems of the human body

Support and movement

Structure and functions of the muscular and skeletal system. Bones and cartilage. Bone development. Bone connection. The structure of the human skeleton. Structure and functions of skeletal muscles. Types of muscles. The mechanism of muscle contraction. Muscle strength. Muscle fatigue.

Blood and lymph

Human body fluids. Composition and function of blood. Protective functions of the blood. Immunity. Specific and nonspecific immunity. Blood clotting.

Blood and lymphatic circulation

The blood circulatory system: heart and blood vessels. Structure and function of the heart. Vascular system, its structure. Flow of blood through the blood vessels. Large and small circle of blood circulation. Regulation of blood flow to organs. Lymphatic circulation and its significance.

Respiration

The role of respiration. Structure and functions of the respiratory organs. Vocal apparatus. Respiratory movements. Gas exchange in the lungs and tissues. Neurohumoral regulation of respiration.

Nutrition and digestion

Energy needs of the body. Types of nutrients. Nutrition and health. Structure and functions of digestive organs, digestive glands. Digestion in the small intestine. Colon functions. Digestive regulation.

Thermoregulation

Maintenance of body temperature. Heat production. Heat transfer. Structure and functions of the skin. The role of the skin in thermoregulation.

The excretory system

Structure and functions of the urinary system. Regulation of the amount of water in the body. The role of the skin in the elimination of waste products.

Endocrine regulation of human body functions

Functioning of the endocrine system. Hormones. Hypothalamic-pituitary axis. Glands of internal secretion.

Reproduction and development

Stages of human ontogenesis. Formation of sexual characteristics. Genetic definition of sex. Genital organs, their structure. Development of germ cells. Menstrual cycle. Fertilization. Embryonic development. Placental functions. Postembryonic human development.

Nervous regulation of human body functions

The structure of the nervous system. Central and peripheral nervous system of the human brain. Regulation of motor activity. Spinal cord. Brain. Brain stem. The cerebellum. Subcortical nuclei. Arbitrary movements and cerebral cortex. Regulation of internal organs. Vegetative (autonomic) nervous system. The sympathetic and parasympathetic nervous systems, their functions. Interaction of regulatory systems of the body.

Perception of information by the nervous system. Sensory systems

The connection of the human body with the outer world. General characteristics of sensory systems. Structure of analyzers. Visual sensory system, auditory sensory system. Sensory systems of taste, smell, balance, movement, touch, temperature, pain.

Formation of human behavior and psyche

Reticular formation of the brain and types of perception. Sleep. Biorhythms. The structure of instinctive behavior, its modification. Types of training. Memory. Types of memory. Acquired behavior.

Thinking and consciousness

Thinking and cerebral cortex. Functional asymmetry of the brain. Language. Individual features of human behavior. Human nature. Consciousness.

Section VII. Biological inheritance and variation

Inheritance patterns

Basic concepts of genetics. Methods of genetic research. Laws of G. Mendel, their statistical nature and cytological basis. Chromosomal theory of heredity. Genetic linkage. Gene interaction. Extranuclear inheritance.

Variation patterns

Genetic recombination. Mutation. Types of mutations. Mutagens. Modification variability.

Section VIII. Development of an organism (ontogeny)

Reproduction of organisms

Asexual reproduction of organisms. Sexual reproduction of organisms. The structure and formation of germ cells.

Genotype as a holistic system

The main patterns of gene functioning in pro- and eukaryotes. Human genetics. The role of genotype and environment in the formation of phenotype. Cell differentiation. Genetic chimerism. Transgenic organisms. Genetic bases of selection of organisms. The main trends of modern biotechnology.

Development of an organism (ontogenesis)

Fertilization. Periods of ontogenesis in multicellular organisms: embryogenesis and post-embryonic development. Influence of genotype and external factors on the

development of the living organism. Diagnosis of human congenital anomalies and their treatment. Regeneration. Plant and animal life cycles. Embryo technologies.

Section IX. Other levels of biological organization

Population. Ecosystem

Characteristics of populations. Sex and age structure of the population. Factors determining population size, population dynamics and its fluctuations.

The concept of habitat, ways of adaptation. Biological adaptive rhythms of organisms.

Communities and ecosystems. Composition and structure of community. Interactions of organisms in ecosystems. Variety of ecosystems. Development and change of ecosystems.

Nutrient cycling and the flow of energy in ecosystems. Ecosystem productivity.

Biosphere

General characteristics of the biosphere. Biogeochemical cycles. Influence of human activity on the conditions of the biosphere. Modern ecological crisis. Population growth and the problems associated with it: food, energy, fresh water shortages, and environmental pollution. Possible ways to overcome the environmental crisis. Rational use of natural resources, alternative energy sources, biodiversity preservation, nature protection. Environmental legislation of Ukraine. International cooperation for nature protection.

Section XV. Historical aspects of the development of the organic world

Fundamentals of theory of evolution

Evolutionary views on human nature. Theories of evolution of Lamarck and Darwin. The main tenets of synthetic theory of evolution: population as an elementary unit of evolution; elementary factors of evolution. Natural selection. Species, speciation. Microevolution. Adaptation as a result of the evolutionary process. Macroevolution.. Modern ideas about the factors of evolution: the synthesis of ecology and evolutionary views.

Biodiversity: historical development

The system of the living organisms as a reflection of its historical development. Hypotheses about the origin of life on Earth. Evolution of unicellular and multicellular organisms. Stages of evolutionary phenomena. The emergence of major groups of organisms on Earth and the formation of ecosystems.

Key characteristics of living systems.

Ways and prospects to apply the achievements of biology to preserve life on Earth.

Examination procedure and format

The exam questions cover all the themes of the subject “Biology”.

The exam is conducted orally on the basis of exam papers approved by the chairman of the admission committee. There are three examination questions to answer. Preparation time - 45 minutes

Assessment of applicants' performance

number of points on a 200-point scale	Descriptors
190-200	The applicant shows thorough knowledge of biology; can answers complicated questions and express ideas using scientific terminology and connections between disciplines; analyzes and identifies the patterns of wildlife; gives examples, based on their own observations; evaluates biological phenomena and laws; determines and explains causal relationships; is able to single out the problem and identify ways to deal with it; is familiar with the main and additional reference material; can solve biological problems of different levels of complexity, makes reasonable conclusions; uses knowledge in unfamiliar situations
171-189	The applicant reproduces the educational material and answers the questions, making minor mistakes in the formation of scientific terms or explaining individual facts; with some help can determine causal relationships; can compare biological objects to phenomena and processes of wildlife; performs simple cognitive tasks; corrects their own mistakes; can do typical biological exercises and problems without assistance; draws vague conclusions; is familiar with basic reference material
161-170	The applicant reproduces the educational material; answers the questions with some inaccuracies; compares biological objects, phenomena and processes of wildlife, differentiating between them; corrects mistakes; solves typical biological problems using the algorithm; draws incomplete and vague conclusions; is familiar with basic reference material
141-160	The applicant reproduces some parts of educational material; answers only some questions; uses general biological terms; characterizes the structure and functions of individual biological objects according to plan; makes mistakes in answers and terminology; solves simple typical biological problems; is familiar with some references, knows some theory, but cannot apply it
124-140	The applicant reproduces a small part of the educational material, can define some biological concepts, gives an incomplete description of the general characteristics of biological objects; may make mistakes and misinterpret some notions, misusing terms; gives examples based on textbook material

0-123	The applicant reproduces a small part of the educational material only as assisted, can define only some biological concepts, gives an incomplete description of the general features of biological objects; the answers contain substantial mistakes, answers simple questions; lacks theoretical knowledge and practical skills; is not familiar with the reference material
-------	--

Recommended literature list

1. Biology: Grade 7 Textbook for Comprehensive Schools / Musiienko M.M., Slavnyi P.S., Balan P.H. K. : Heneza, 2007. 288 p.
2. Biology: Grade 7 Textbook for Schools / Sobol V.I. / – K. : Hramota, 2007. – 296 p.
3. Biology: Grade 7 Textbook / Ilchenko V.P., Rybalko L.M., Piven T.O. /K. : Dovkillia-K, 2007. 240 p.
4. Biology: Grade 8 Textbook for Schools / Mezhzherin S.V., Mezhzherina Ya.O. / K. : Osvita, 2008. 258 p.
5. Biology: Grade 8 Textbook for Comprehensive Schools /Bazanova, Pavichenko Yu.V., Shatrovskiy O.H. / K. : Himnaziia, 2008. 320 p.
6. Biology: Grade 8 Textbook for Comprehensive Schools / Zaporozhets N.V., Vlashchenko S.V. / K. : AN HRO PLIUS, 2008. 288 p.
7. Biology: Grade 8 Textbook for Comprehensive Schools / Balan P.H., Serebriakov VV. / K. : Heneza, 2008. 304 p.
8. Biology: Grade 9 Textbook for Comprehensive Schools. / Matiash N.Yu., Shabatura M.N. / K. : Heneza, 2009. 272 p.
9. Biology: Grade 9 Textbook for Comprehensive Schools. / Stepaniuk A.V. et al. / Ternopil : Pidruchnyky i Posibnyky, 2009. 288 p.
10. Biology: Grade 9 Textbook for Comprehensive Schools. / Strashko S.V. et al. / K. :Hramota, 2009.296 p.
11. Biology: Grade 9 Textbook for Comprehensive Schools. / Bazanova T.I. et al. / K. : Svit Dytynstva, 2009. 296 p.
12. Biology: Grade 10. Textbook for Comprehensive Schools./ Danylova O.V. et al. / K. : Torsinh, 2006.
13. Biology: Textbook for Comprehensive Schools.: certificate level, academic level / Balan P.H., Verves Yu. H., Polishchuk V.P. / K. : Heneza, 2010. 288 p.
14. Biology: Grade 10. Textbook for Comprehensive Schools. (certificate level, academic level) / Tahlina O.V.. / K. : Ranok, 2010. 256 p.
15. Biology: (major subject level): Grade 10. Textbook for Comprehensive Schools. / Mezhzherin S.V., Mezhzherina Ya.O., Korshevniuk T.V. / K. : Planeta Knyzhok, 2010. 336 p.
16. Ecology. Grade 10: major subject level: textbook / Tsaryk L.P., Vitenko I.M., Tsaryk P.L. K.: Heneza, 2010. 240 p.
17. Fundamentals of Ecology (textbook) / Biliavskiy H.O. et al. / K. : Lybid, 2000. 334 p.
18. general Biology: Grade 11. Textbook for Comprehensive Schools./ Kucherenko M.Ye. et al. K. : Heneza, 2006. 272 p.