

BIOLOGY
6– 9 forms

Education program
for general education institutions ¹

¹ This program is ratified by the Order of Ministry of Education and Science of Ukraine as of 07.06.2017
No. 804

6th form

(70 hours – 2 hours per week, with reserved 6 hours)

Learning outcomes	Syllabus
Introduction (4 hours)	
<p>Knowledge uses the following terms: - biology, observation, experiment names: - main characteristics of living things (growth, reproduction, cooperation with outer world); gives examples of: - basic nature groups (bacteria, plants, animals, fungus); - methods of biological research of organisms (observation, description, comparison, experiment) understands: connection between nature objects make conclusions on: understanding of nature estimates a value of: biological knowledge for practical activities (medicine, agriculture, environmental protection etc)</p> <p>Practice (skills) distinguishes: nature objects; applies: observation method of biological objects</p>	<p>Biology is a science of life. Main characteristics of living things. <i>Life Sciences.</i> Diversity of life (exemplified by the representatives of basic nature groups). <i>Concept of viruses.</i> Methods of biological research of organisms.</p> <p>Demonstration of nature objects (including electronic media)</p>
Topic 1. Cell (0 hours)	
<p>Knowledge uses the following terms: - cell, cellular membrane, cell wall, cytoplasm, cell nucleus, plastid, mitochondria, tonoplast names: - main elements of light microscope; - basic characteristics of a cell: growth, division, cooperation with outer world gives examples of: - cell parts (cellular membrane, cell wall, cytoplasm, cell nucleus, organelle: plastid, mitochondria, tonoplast); compares: plant and animal cell</p> <p>Practice (skills) recognizes: - plant and animal cells and their parts on models and photographs; - parts of slides of plant cells; is able to: - work with school light microscope and get clear image of microscopic object; - make slides of plant cells; stick to the rules of: - working with microscope and laboratory equipment</p>	<p>Cell as a unit of living things Magnifiers (magnifying glass, microscopes). <i>History of cell studies.</i> General plan of cell structure. Structure of plant and animal cell. Basic characteristics of a cell (growth, division, cooperation with outer world) <i>Main principles of cell theory</i></p> <p>Demonstration of models, pictures (including electronic ones) of plant and animal cells. Laboratory studies: Cell structure (elodea plant, ashberry, watermelon, tomato etc). Practical works: 1. Structure of light microscope and work with it. 2. Making slides of onion peel and its examine through optical microscope</p>

Topic2. Single-cellular organisms. Transition to multicellularity (8 hours)

<p>Knowledge uses the following terms: - bacteria, single-cellular organisms, colonial organisms, multi-cellular organisms names: - surrounding of single-cellular organisms; - elements of bacterial cell; gives examples of: - single-cellular organisms, <i>colonial organisms and multi-cellular organisms without tissues</i>; knows: - structure of single-cellular organisms; identifies: - life processes (nutrition, breathing, irritability, reproduction, motion) Practice (skills) recognizes (on patterns and pictures): - single-cellular organisms (among studied ones); describes: - environment and structure of single-cellular organisms (exemplified by the studied organisms); - <i>life processes of single-cellular organisms</i>; compares by specified features: - <i>structure and life processes of single-cellular organisms (exemplified by the studied organisms)</i>; applies knowledge: - for prevention of infectious and parasitic diseases; - on life processes of single-cellular organisms in everyday living; stick to the rules of: - working with microscope;</p>	<p>Bacteria as the smallest single-cellular organisms. Single-cellular organisms (exemplified by chlamydomonas, representatives of diatoms, euglena, ameba, infusorian). <i>Examples of single-cellular representatives</i> Parasitic single-cellular organisms. Environment of single-cellular organisms, <i>their life processes and structure</i>, position in nature and human life <i>Colonial organisms and transition to multicellularity (sponge, sea lettuce).</i></p> <p>Demonstration of slides of single-cellular organisms; image collection (including electronic ones) of single-cellular organisms, colonial organisms and multi-cellular organisms (exemplified by studied ones). Laboratory studies Infusorian observation. Mini-project (<i>topics on teacher's choice</i>)</p>
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Topic 3. Plants (20 hours)

<p>Knowledge uses the following terms: - plants, vegetative organs (root, caulis, leaf, bud), gamogenesis and agamogenesis of plants, photosynthesis, plant nutrition, flower, inflorescence, pollination. fertilization, seed, fruit names: - basic vital processes of plants (growth, nutrition, photosynthesis, breathing, motion of substances); - conditions and substances necessary for vital activity of plants; - conditions for photosynthesis; - plant reproduction (gamogenesis and agamogenesis); gives examples of: - <i>plant tissues</i> and organs; - pollination; - plant reproduction (3-4);</p>	<p>Plant as a living thing. Photosynthesis as a peculiar feature of plants, nutrition, breathing, motion. Plant structure. <i>Plant tissues</i>. Plant organs. Root, caulis: structure and main functions Variation and modification of vegetative organs. Plant reproduction: gamogenesis and agamogenesis. Vegetative reproduction of plants. Flower. Inflorescence. Pollination. Fertilization. Seed. Fruit. Ways of dissemination.</p> <p>Demonstration: of research confirming: photosynthesis; breathing; water evaporation; root absorption</p>
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<ul style="list-style-type: none"> - plant motion; - plants with root variation (3-4), - plants with variation in shoot and its parts (3-4); - plants with different inflorescences, fruit and ways of dissemination (3-4); <p>explains:</p> <ul style="list-style-type: none"> - pollination and fertilization; <p>characterizes:</p> <ul style="list-style-type: none"> - structure of root, footstalk, leaf according to its functions; - bulb as a shoot bud; - flower as an organ of seed fertilization <p>Practice (skills)</p> <p>describes:</p> <ul style="list-style-type: none"> - growth and development of a plant (growth of a plant from a seed); <p>recognizes:</p> <ul style="list-style-type: none"> - plant cells, <i>tissues</i> and organs; - potato bulb and rhizome as variations of ground shoots; <p>compares by specified features:</p> <ul style="list-style-type: none"> - photosynthesis and breathing processes; - gamogenesis and agamogenesis; <p>identifies:</p> <ul style="list-style-type: none"> - biological importance of variations of vegetative organs (using examples); - biological importance of inflorescence, fruit; <p>analyzes:</p> <ul style="list-style-type: none"> - importance of photosynthesis, nutrition, breathing and evaporation for plants; <p>plans:</p> <ul style="list-style-type: none"> - own observations of plant structure and vital activity; <p>predicts:</p> <ul style="list-style-type: none"> - results of own observations; <p>applies:</p> <ul style="list-style-type: none"> - research of plant organ structure; - experiments confirming main processes of plant vital activities; <p>is able to:</p> <ul style="list-style-type: none"> - reproduce plants; - sprout seeds; - fix results of experiments and research; - model biological objects and processes; <p>stick to the rules of:</p> <ul style="list-style-type: none"> - working with microscope and laboratory equipment; <p>applies knowledge:</p> <ul style="list-style-type: none"> - plant management 	<p>of water, <i>influence of mineral substances on plant development</i>;</p> <ul style="list-style-type: none"> - slides of inner structure of root, caulis, leaf <p>Laboratory studies of:</p> <ul style="list-style-type: none"> root structure; shoot structure; bud structure; bulb structure; flower structure; seed structure; fruit structure. <p>Research practical work</p> <p>Research of growth of vegetative organs. Observation of shoot development from a bud. Substance s motion in a plant. Vegetative reproduction of plants Analysis of conditions for seed sprouting</p> <p>Mini-project (<i>topics on teacher's choice</i>)</p>
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Topic 4. Variety of plants (12 hours)

<p>Knowledge</p> <p>uses the following terms:</p> <ul style="list-style-type: none"> - plant groups, water-weed, moss, fern, gymnosperm, angiosperm, the Red Book of Ukraine <p>names:</p>	<p>Ways of plant classification (<i>surrounding, structure, reproduction, etc.</i>)</p> <p>Water-weed (green algae, red ware, red algae).</p> <p>Moss.</p>
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<p>- surrounding of water-weed, moss, <i>horsetails</i>, <i>lycopodiums</i>, fern, gymnosperm and angiosperm; - plant groups reproducing by sporidiums and seeds; - <i>basic life forms of plants</i>; - <i>basic ecological groups of plants</i>; - main types of plant groups; - rare plants of locality; gives examples of: - water-weed (2-3); - moss, <i>horsetails</i>, <i>lycopodiums</i>, fern (2-3); - gymnosperm and angiosperm (4-5); - plants of different ecological groups (2-3); - plants of different life forms (4-5); - dominant plants of different plant groups: forests, steps, meadows, marshes (4-5); - adaptation to surrounding (4-5); identifies: peculiarities of plant reproduction by sporidiums and seeds</p> <p>Practice (skills) recognizes: - different group of plants (water-weed, moss, horsetails, lycopodiums, fern, gymnosperm and angiosperm); - <i>main life forms of plants</i>; - <i>plants of different ecological groups</i>; - main types of plant groups; describes: - structure of water-weed, moss, horsetails, lycopodiums, fern, gymnosperm (exemplified by conifers) and angiosperm (phanerogam); - reproduction of water-weed, moss, <i>horsetails</i>, <i>lycopodiums</i>, fern, gymnosperm and angiosperm (phanerogam); compares by specified features: plant of different groups and life forms, etc. is able to: choose indoor plants according to certain conditions</p>	<p>Fern, <i>horsetails</i>, <i>lycopodiums</i>. Gymnosperm. Angiosperm (phanerogam); <i>Ecological group of plants (by light, water, temperature)</i> <i>Life forms of plants.</i> Plant groups. Significance of plants for life on Planet Earth. Significance of plants for human life.</p> <p>Demonstration representatives of different plant groups, herbarium samples, picture collection (including electronic ones). Laboratory studies: filamentous algae structure; moss structure; plant structure; coniferous shoot and strobilus structure</p> <p>Practical works: 3. Comparing moss, fern and Angiosperm (phanerogam) structure. 4. Choosing indoor plants according to certain conditions. Mini-project (<i>topics on teacher's choice</i>)</p>
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Topic 5. Fungus (9 hours)

<p>Knowledge uses the following terms: - fungi, lichen names: - the most common fungi of locality; - features of fungal cell; - common and distinguishing features of fungus, plant and animal cell structure; - main fungus groups according to way of nutrition; - ways of fungus reproduction and dissemination; - lichen groups (crustaceous, fruticose, foliose); gives examples of: - edible and poisonous fungi of the locality; - common life of fungi and plants;</p>	<p>Peculiarities of fungi nutrition, life and structure: fungal cell, spore, fungal fruit Reproduction and dissemination Fungi groups: symbiotic - mycorrhizal pileate fungi; lichen; saprotrophic - mold fungi, yeast fungus; parasitic fungi (exemplified by timber fungus and mycose agents) Significance of fungi for nature and human life.</p> <p>Demonstration of living objects, patterns, pictures of edible, poisonous, mold, parasitic fungi and lichen;</p>
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<p>characterizes:</p> <ul style="list-style-type: none"> - peculiarities of fungus nutrition; - structure of shiro and fungal fruit; - lichen structure; <p>Practice (skills)</p> <p>compares by specified features:</p> <ul style="list-style-type: none"> - fungi and plants; - mold and pileate fungi; <p>explains:</p> <ul style="list-style-type: none"> - connection of fungi and higher plant; - co-existence of fungi and water-weed in lichen; - significance of fungi for nature; - significance of fungi-breeding; <p>recognizes:</p> <ul style="list-style-type: none"> - edible and poisonous fungi of the locality; - lichen; <p>stick to the rules of:</p> <ul style="list-style-type: none"> - working with microscope and laboratory equipment; <p>analyzes:</p> <ul style="list-style-type: none"> - human use of fungi and lichen; <p>is able to:</p> <ul style="list-style-type: none"> - identify poisonous fungi (on the locality) <p>applies knowledge for:</p> <ul style="list-style-type: none"> - storing food; - for prevention of diseases caused by fungi; - prevention of mushroom poisoning. 	<p>Laboratory studies structure of pileate fungi.</p> <p>Practical work: 5. Identification of edible and poisonous fungi of the locality.</p> <p>Mini-project (<i>topics on teacher's choice</i>)</p>
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Conclusion (2 hours)

<p>Knowledge</p> <p>names: peculiarities of main groups of organisms;</p> <p>explains: peculiarities of structure and vital activities according to surrounding.</p> <p>Practice (skills)</p> <p>describes:</p> <ul style="list-style-type: none"> - structure and vital activities of plant, animal, fungi and bacteria cells; <p>compares:</p> <ul style="list-style-type: none"> - structure and vital activities of main groups of organisms; <p>classifies:</p> <ul style="list-style-type: none"> - organisms according to certain criteria and group them 	<p>Organisms' structure and vital activities</p>
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7th form

(70 hours – 2 hours per week, with reserved 6 hours)

Learning outcomes	Syllabus
Introduction (approximately 4 hours)	
<p>Knowledge uses the following terms: - animals, autotrophic organism, heterotrophic organism names: - animal habitat; - animal vital activities; - elements of animal cell; - <i>animal tissues</i>, organs, organ systems and their functions; explains: - difference between animals, plants and fungi exercises judgment: - on significance of knowledge of animals in nature and human life</p> <p>Practice (skills) recognizes: - animal cells, <i>tissues</i>, organs, organ systems; describes: - animal body structure, using <i>taxidermied animals</i>, models, <i>wet mounts</i>, collections; characterizes: - nutrition types: autotrophic and heterotrophic nutrition; compares: - animal, plant, fungi cells</p>	<p>Main difference of animal, plants and fungi. Peculiarities of animal nutrition. Animal structure: cells, <i>tissues</i>, organs and organ systems.</p> <p>Demonstration: <i>taxidermied animals</i>, <i>wet mounts</i>, animal picture collection (including electronic ones).</p>
Topic 1. Variety of animals (26 hours)	
<p>Knowledge uses the following terms: - species, invertebrate, chordates names: - animal habitat and living; - peculiarities of external structure distinguishing animals from other group of organisms; - rare animal species of Ukraine and locality; gives examples of: - animals of particular groups; - animal species of Ukraine and locality; - species of animals which are parasites and vector of human diseases exercises judgment: - on diversity of animals, their significance for nature and human life;</p>	<p>[peculiarities of structure, living, variety, significance for nature and human life of the specified group are studied]. Classification of animals (by habitat, motion, living, etc.) Coelenterate. Annelides. Arthropods: Crustacean, Araneidan, Insects. Shell. Invertebrate parasites. Fish. Amphibian. Reptilian. Birds. Mammals.</p> <p>Demonstration of slides, <i>taxidermied animals</i>, <i>wet mounts</i>, animal picture collection (including electronic ones) Laboratory studies: annelides external structure and motion (as exemplified by earthworm or sewage worm); shell structure of gastropods and bivalves.</p>

<p>- on knowledge about biological peculiarities of invertebrate parasites to prevent infection they can cause;</p> <p>Practice (skills) recognizes: animals on pictures, in collections (as exemplified by animals from syllabus); characterizes: - animal adaptation to water life; - animal adaptation to land life; - animal adaptation to soil life; - animal adaptation to fly; - animal adaptation to life as parasite (as exemplified by parasite worms and arthropods). identifies connection - between animal structure and way of life; improves skills of - working with natural objects and laboratory equipment; stick to the rules of - personal hygiene to prevent diseases caused by invertebrate parasites</p>	<p>Practical works: 1. Identifying examples of insects adapting to living conditions; 2. Identifying examples of different ecological group of birds adapting to living conditions 3. Determination of peculiarities of external structure of spinals according to adaptation to various living conditions.</p> <p>Mini-project (<i>topics on teacher's choice</i>)</p>
<p>Topic 2. Animal Living (16 hours)</p>	
<p>Knowledge uses the following terms: nutrition, breathing, substance transport, elimination, motion, irritability, reproduction, growth, development. names: - life processes of animals: nutrition, breathing and gaseous exchange, substance transport, elimination, motion, irritability, reproduction, growth and development. names: - organs of digestion, breathing (gaseous exchange), blood circulation, elimination; - basic functions of blood and types of circulatory systems; - skeleton types; - types of body symmetry; - sense organs; - reproduction forms; - reproductive cells; - development types; explains: - significance of nutrition, breathing, gaseous exchange, substance transport, elimination, reproduction, skin coverings, nervous system and sense organs for organism; make conclusion on:</p>	<p>Nutrition and digestion. <i>Peculiarities of metabolism of heterotrophic organism. Variety of digestive systems.</i> Animal breathing and gaseous exchange. Respiratory organs, their variety. Significance of breathing processes. Substance transport. Open and closed circulatory systems. Blood and its basic functions. Elimination and its importance for the body, Animal elimination organs. Support and motion. Skeleton types. Significance of supporting-motor system. Two types of symmetry depicting mode of living. Ways of animal motion. Animal skin coverings, their variety and functions. Sense organs and their importance. Nervous system, its significance, <i>development by different animals.</i> Reproduction and its importance. Forms of animal reproduction. Reproductive cells and fertilization. Animal development (with and without transformation). <i>Periods and life time of animals.</i> Laboratory studies:</p>

<p>- complication of animal body structure connected with function improvement and development;</p> <p>proves: connection between structure and function of organs</p> <p>Practice (skills) distinguishes (on pictures):</p> <ul style="list-style-type: none"> - animal organ systems; - type of symmetry of animal bodies; - types of circulatory systems; - type of animal development; <p>characterizes:</p> <ul style="list-style-type: none"> - <i>variety of animal digestive systems;</i> - substance transport for different types of animals; - radial and bilateral symmetry; - ways of animal motion; - variety of animal skin coverings; - <i>peculiarities of nervous system and sense organs of different animal groups;</i> - reproduction forms, fertilization; - direct and indirect development; <p>compares:</p> <ul style="list-style-type: none"> - breathing organs and systems of different animal groups; - living displays of different animal groups (nutrition, digestion, breathing, eliminations); <p>stick to the rules of:</p> <ul style="list-style-type: none"> - working with natural objects and laboratory equipment; 	<p>peculiarities of animal skin coverings; animal age determination (as exemplified by bivalves and bony fish).</p> <p>Practical works:</p> <ol style="list-style-type: none"> 4. <i>Comparing circulatory systems of spinal animals</i> 5. <i>Comparing skeletons of spinal animals</i> 6. <i>Comparing brain structure of spinal animals (on models).</i> <p>Mini-project (<i>topics on teacher's choice</i>)</p>
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Topic 3. Animal behavior (approximately 10 hours)

<p>Knowledge uses the following terms: instinct, learning, animal behavior, migration</p> <p>names:</p> <ul style="list-style-type: none"> - methods of observation of animal behavior; - animal behavior patterns; - animal groups; <p>gives examples of:</p> <ul style="list-style-type: none"> - animal migration; - ways of animal positioning; - use of working tools by animals; <p>explains:</p> <ul style="list-style-type: none"> - changes of animal behavior with age; - cyclic behavior changes <p>Practice (skills) recognizes (by description and video materials):</p> <ul style="list-style-type: none"> - animal behavior patterns; - animal groups; 	<p>Animal behavior and methods of its research. Native and acquired behavior. Ways of animal positioning. Homing. Animal migration.</p> <p>Behavior patterns: investigative, feeding, protective, sanitary, reproductive (animal partners, parental behavior and care), territorial, social. Types of animal groups by K. Lorenz. Group hierarchy. Animal communication. Use of working tools by animals. Elementary intellectual functioning. <i>Evolution of animal behavior, its adaptive significance.</i></p> <p>Laboratory studies: observation of animal behavior (pattern is identified by a teacher).</p> <p>Practical works:</p>
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<p>characterizes: - biological significance of native and acquired behavior; - behavior patterns; observes and describes: - animal behavior; plans study progress, predicts results and fixes them</p>	<p>8. Identification of behavior patterns (or group) (using videos or description) Mini-project (<i>topics on teacher's choice</i>)</p>
<p>Topic 4. Organisms and their habitat (6 hours)</p>	
<p>Knowledge uses the following terms: - ecosystem, herbivores, carnivores, parasites, food chains, nature protection, the Red Book of Ukraine names: - habitat factors; - reservations and reserved areas in Ukraine; gives examples of: - animal adaptation to different environmental factors (temperature, light, moisture); - cooperation in groups; - human impact on ecosystem exercises judgment: - on cooperation of organisms in ecosystem; evaluates: - reserved areas in Ukraine and locality</p> <p>Practice (skills) describes: - energy flow in ecosystem; characterizes: - cooperation of organisms with each other and with environment; identifies: - role of organisms as part of ecosystem</p>	<p>Concepts of ecosystem and environmental factors. Food chains. <i>Substance circulation and energy flow in ecosystem.</i> Cooperation in groups. Human impact on ecosystem. <i>Ecological morality.</i> Nature reserves. the Red Book of Ukraine.</p> <p>Mini-project (<i>topics on teacher's choice</i>)</p>
<p>Conclusion (2 hours)</p>	
<p>Knowledge names: - description of basic organism groups (plants, animals, fungi, bacteria); - representative of basic organism groups on pictures and by description; make conclusion on: - unity of wildlife Practice (skills) compares: - structure and life processes of basic organism groups (plants, animals, fungi, bacteria)</p>	<p>Similarity in structure and life processes of plants, bacteria, fungi and animals is a prove of unity nature</p>
<p>Excursions Animal variety in locality. Adaptation of plants and animals to life together in nature groups</p>	

8th form

(70 hours – 2 hours per week, with reserved 4 hours)

Learning outcomes	Syllabus
INTRODUCTION (approximately 2 hours)	
<p>Knowledge uses the following terms: - biosocial human origin names: - <i>human sciences</i>; explains: - place of human in organic system; - peculiarities of biological human origin and its social essence; characterizes: - <i>research methods of human organism</i> exercises judgment: on human organism as a biological system</p> <p>Practice (skills) shows characteristic features of: - biological human origin and its social essence in communities</p>	<p>Biosocial human origin. <i>Human sciences.</i> <i>Research methods of human organism.</i> Significance of knowledge on human for health maintenance.</p>
TOPIC 1. HUMAN ORGANISM AS A BIOLOGICAL SYSTEM (7 hours)	
<p>Knowledge uses the following terms: - tissue, organ, organ system, regulations (nervous, humoral, immune), neuron, reflex, reflex arch names: - tissues, organs and physiological systems of human body; - parts of reflex arch; characterizes: - cellular structure of human body; - tissues of human body; - neuron structure; - neural impulse in reflex arch; gives examples of: - tissues; - organs, physiological systems; explains: - differences between nervous and humoral regulation of physiological functions of a body proves judgments: - on human organism as an entire and open biological system; make conclusion on: - nervous and humoral regulation as basic of organism integrity;</p> <p>Practice (skills) recognizes: - human organs and organ systems; - types of tissues in human body (on pictures and slides); identifies connection between:</p>	<p>Human organism as a biological system. Variety of human cells. Tissues. Organs. Physiological systems. Concept of regulations. Nervous regulation. Neuron. Reflex. Reflex arch. Humoral regulation. Hormones. Immune regulation.</p> <p>Demonstration of organ models, slides of human tissues. Laboratory research: introduction to slides of human tissues</p>

<ul style="list-style-type: none"> - tissues structure and functions; <i>compares</i> - organs and organ systems in human body and other organisms; stick to the rules of: - working with microscope and laboratory equipment 	
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TOPIC 2. SUPPORT AND MOTION (6 hours)

<p>Knowledge uses the following terms:</p> <ul style="list-style-type: none"> - skeleton, bone, cartilage, union of bones, muscle, posture, hypodynamia <p>names:</p> <ul style="list-style-type: none"> - parts of supporting-motor system; - skeleton parts; - bone types; - union of bones types; - peculiarities of human skeleton, caused by bipedalism; - basic groups of skeletal muscles. <p>characterizes:</p> <ul style="list-style-type: none"> - functions of supporting-motor system; - tissues: bone, cartilaginous, striated muscular; - growth and age-related changes of bone structure. <p>explains:</p> <ul style="list-style-type: none"> - significance of physical activities for skeleton and muscle formation; - mode of life and its influence on formation and development of skeleton. <p>gives examples of:</p> <ul style="list-style-type: none"> - static and dynamic work <p>exercises judgments:</p> <ul style="list-style-type: none"> - on motion activity to maintain health; - physical activity and its influence on development of skeletal muscles <p>evaluates:</p> <ul style="list-style-type: none"> - significance of the first aid for supporting-motor system injuries <p>Practice (skills) recognizes (on pictures, models and own body):</p> <ul style="list-style-type: none"> - bone types, skeleton parts, union of bones, groups of skeletal muscles. <p>compares:</p> <ul style="list-style-type: none"> - human and mammal skeleton. <p>applies knowledge for:</p> <ul style="list-style-type: none"> - prevention of supporting-motor system diseases and injuries; - first aid for supporting-motor system injuries. <p>stick to the rules of:</p> <ul style="list-style-type: none"> - working with microscope and laboratory equipment 	<p>Significance of supporting-motor system, its structure and functions. Bones, cartilages. Skeleton structure. Union of bones. Structure and functions of skeletal muscles. Muscle work. Muscle fatigue. Basic groups of skeletal muscles. <i>Development of supporting-motor system with age.</i> First aid for supporting-motor system injuries. Prevention of supporting-motor system diseases and injuries</p> <p>Demonstration human and mammal skeleton; human limbs; different bones; vertebrae; decalcified bone.</p> <p>Laboratory studies</p> <ul style="list-style-type: none"> - microstructure of bone, cartilaginous and muscular tissues; - fatigue after static and dynamic loading; rhythm and loading and their influence on muscle fatigue. <p>Project (<i>topics on teacher's choice</i>)</p>
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TOPIC 3. METABOLISM AND ENERGY FLOW IN HUMAN ORGANISM (3 hours)

<p>Knowledge uses the following terms:</p> <ul style="list-style-type: none"> - metabolism, energy demands, vitamins 	<p>Metabolism and energy flow in human organism is a main feature of a living thing</p>
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<p>names:</p> <ul style="list-style-type: none"> - food elements <p>gives examples of:</p> <ul style="list-style-type: none"> - vitamins (water-soluble and fat-soluble) <p>characterizes:</p> <ul style="list-style-type: none"> - product ingredients; - food as a source of energy; - metabolism and energy flow in human organism; - food and energy demands. <p>explains:</p> <ul style="list-style-type: none"> - functional meaning of proteins, fats, carbohydrates, water and minerals for human body <p>exercises judgment:</p> <ul style="list-style-type: none"> - on significance of balanced nutrition for normal development and health maintenance; - on significance of proteins, fats and carbohydrates of vegetable and animal origin for teenagers; <p>evaluates:</p> <ul style="list-style-type: none"> - significance of metabolism for normal functions of human organism; <p>make conclusion on:</p> <ul style="list-style-type: none"> - necessity of correlation between weight and height; <p>understands meaning of:</p> <ul style="list-style-type: none"> - <i>contribution of scientists to vitamin knowledge (M. I. Lunin, Kh. Eijkman, K. Funk etc.), including Ukrainian scientists (O. V. Palladin)</i> <p>Practice (skills)</p> <p>applies knowledge for:</p> <ul style="list-style-type: none"> - ways to preserve vitamins in food; - analyzing food ration; - choosing food ration according to energy consumption 	<p>Nutrition and metabolism. Food ingredients. Significant of food ingredients. Food and energy demands.</p> <p>Research practical work Self-observation of correlation between weight and height</p> <p>Project Balanced nutrition (<i>or topic on teacher's choice</i>)</p>
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TOPIC 4. DIGESTION (6 hours)

<p>Knowledge</p> <p>uses the following terms:</p> <ul style="list-style-type: none"> - digestion, digestive system, digestive route, digestive glands, enzymes, absorption <p>names:</p> <ul style="list-style-type: none"> - organs of digestive system; - digestive glands; - diseases of digestive system; <p>characterizes:</p> <ul style="list-style-type: none"> - function of digestive system; - teeth structure and functions; - swallowing, digestion, absorption processes; - regulation of digestion; <p>gives examples of:</p> <ul style="list-style-type: none"> - ferment; <p>explains:</p> <ul style="list-style-type: none"> - significance of digestive enzymes; - role of liver and pancreas gland in digestion; - role of teeth in digestion; 	<p>Significance of digestion. Digestive system. Digestive processes: swallowing, vermicular movement, absorption. <i>Regulation of digestion.</i> Nutritional disorders and their prevention.</p> <p>Demonstration teeth models; models of digestive organs.</p> <p>Laboratory studies teeth external structure (with models).</p> <p>Research practical work Effect of salivary enzymes on starch</p>
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<ul style="list-style-type: none"> - significance of gut flora; - negative influence of alcohol and tobacco on digestion; - causes of gastrointestinal diseases <p>exercises judgment:</p> <ul style="list-style-type: none"> - on importance of knowledge on functions and structure of digestive system for maintenance of health; <p>understands:</p> <ul style="list-style-type: none"> - importance of gastrointestinal diseases prevention; <p>understands meaning:</p> <ul style="list-style-type: none"> - <i>contribution of scientists to digestion knowledge (I. P. Pavlov, O. M. Ugoliev etc.)</i> <p>Practice (skills)</p> <p>recognizes (on pictures and models):</p> <ul style="list-style-type: none"> - digestive organs; - elements of teeth external structure; <p>observes and describes:</p> <ul style="list-style-type: none"> - effect of salivary enzymes on starch; <p>applies knowledge for:</p> <ul style="list-style-type: none"> - dental illness prevention; - gastrointestinal diseases and food poisoning prevention 	
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TOPIC 5. BREATHING (4 hours)

<p>Knowledge</p> <p>uses the following terms:</p> <ul style="list-style-type: none"> - breathing, airways, lungs, gaseous exchange, vital lung capacity <p>names:</p> <ul style="list-style-type: none"> - breathing stages; - respiratory system; - diseases of respiratory system; <p>characterizes:</p> <ul style="list-style-type: none"> - process of voice creation and language sounds; - gaseous exchange in lungs and tissues; - inhale and exhale; - vital lung capacity; - neurohumoral regulation of respiratory movements; <p>explains:</p> <ul style="list-style-type: none"> - significance of breathing; - impact of environment on respiratory system. <p>understands:</p> <p>negative impact of smoking on respiratory system</p> <p>Practice (skills)</p> <p>recognizes (on pictures and models):</p> <ul style="list-style-type: none"> - respiratory system; <p>compares:</p> <ul style="list-style-type: none"> - difference of air composition with is inhaled and exhaled; - gaseous exchange in lungs and tissues; <p>makes connection between:</p> <p>structure and functions of respiratory system;</p>	<p>Significance of breathing. Respiratory system</p> <p>Gaseous exchange in lungs and tissues</p> <p>Respiratory movements.</p> <p><i>Neurohumoral regulation of respiratory movements.</i></p> <p>Prevention of diseases of respiratory system.</p> <p>Demonstration</p> <p>models of lungs, larynx;</p> <p>models that explain inhale and exhale;</p> <p>experiment on identifying carbon dioxide in air</p>
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TOPIC 6. SUBSTANCE TRANSPORT (7 hours)

Knowledge

uses the following terms:

- internal environment (blood, lymph, tissue fluid), red blood cells, white blood cells, blood platelets, blood clotting, blood types, blood circulation, arterial pressure, immunity

names:

- structure of internal environment;
- composition and functions of blood and lymph;
- blood vessels;
- factors influencing cardiovascular system;
- immunity types;
- organs providing immunity;

characterizes:

- blood plasma;
- blood clotting as defensive mechanism in the body;
- ABO blood types, Rh rhesus;
- immune reactions;
- structure and properties of heart muscle;
- heart structure and performance;
- cardiac cycle;
- *automaticity of heart performance*;
- structure of blood vessels;
- systemic circulatory system and lesser circulation;
- vessel sanguimotion;
- arterial pressure;
- lymph circulation;

explains:

- correlation between structure and functions of red blood cells, white blood cells, blood platelets, blood vessels, heart;
- significance of lymph, tissue fluid;
- significance of internal environment in human life;
- first aid for bleeding

exercises judgment:

- on significance of stable internal environment for human body (homeostasis);
- on importance of knowledge on structure and functions of circulatory system to maintain health;
- on significance of vaccination;

evaluates:

- epidemiologic situation with AIDS in Ukraine;

understands meaning of:

- *contribution of scientists to knowledge of internal environment and circulatory system (W. Harvey, E. Jenner, P. Ehrlich, K. Landsteiner, L. Pasteur etc.), including Ukrainian scientists (I. I. Mechnikov, M. M. Amosov)*

Practice (skills)

recognizes (on pictures):

- blood cells;
- circulation organs;
- elements of heart structure;

compares:

Internal environment. Homeostasis.

Structure and functions of blood.

Lymph. Blood clotting. Blood types and blood transfusion.

Immune system. Immunity.

Natural and acquired immunity.

Vaccination. Allergy. AIDS.

Circulatory system

Heart: structure and functions. Heart performance.

Structure and performance of blood vessels. Sanguimotion.

Bleeding.

Prevention of cardiovascular diseases

Demonstration of

models of heart, blood vessels, measurement of blood pressure

Laboratory studies:

measurement of heart rate.

Laboratory works:

Blood microstructure.

Research practical work

self-measurement of heart rate during day and week

<p>structure of arteries, veins and capillaries; - natural and acquired immunity; distinguishes: - types of bleeding; observes and describes: - blood microstructure; applies knowledge: - for prevention of cardiovascular diseases; - first aid for bleeding; is able to: - take pulse rate; stick to the rules of: - working with microscope and laboratory equipment; - making pictures of biological objects</p>	
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TOPIC 7. ELIMINATION. TEMPERATURE REGULATION (4 hours)

<p>Knowledge uses the following terms: - elimination, kidneys, nephron, urine formation, skin, temperature regulation names: - eliminative organ; - structure and functions of urinoexcretory system; characterizes: - kidneys structure and functions; - process of urine formation; - <i>regulation of urinary excretion</i>; - role of kidneys in salt and water metabolism; - factors influencing kidneys functions; - negative impact of alcohol on kidneys performance; - role of skin in elimination; - role of skin in temperature regulation; explains: - biological significance of elimination; - causes of heat and sun stroke exercises judgment: - on significance of elimination of metabolic end products; - on significance of skincare to maintain health;</p> <p>Practice (skills) recognizes (on pictures and models): - nephron structure; - skin structure; - organs of urinoexcretory system, makes connection between: skin structure and functions applies knowledge for: - prevention of diseases of urinoexcretory system; - prevention of dermal diseases; - prevention of heat and sun stroke; - first aid for heat and sun stroke evaluates: - significance of skin in adaptation to the environment</p>	<p>Elimination as an important state of metabolism. Structure and functions of urinoexcretory system. Kidney diseases and their prevention. Skin structure and performance. Temperature regulation. First aid for thermal skin lesion (burns, cold injuries), for heat and sun stroke Dermal diseases and their prevention.</p> <p>Demonstration of models of skin and kidney structure. Project Determination of skin types on different parts of the face and framing rules of skincare <i>(or topic on teacher's choice)</i></p>
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**TOPIC 8. CONNECTION OF HUMAN BODY WITH THE ENVIRONMENT.
NERVOUS SYSTEM
(5 hours)**

<p>Knowledge uses the following terms: - nervous system, central nervous system, peripheral nervous system, autonomous (vegetative) nervous system, somatic nervous system names: - components of central and peripheral nervous system; - functions of spinal cord, brain and its brain divisions, somatic nervous system, vegetative nervous system (sympathetic and parasympathetic); - factors interfering with nervous system; characterizes: - structure of brain and spinal cord; - <i>nervous control of motion activity</i>; - <i>role of brain cortex in regulation of voluntary movements</i>; - role of vegetative nervous system for performance of internal organs; gives examples of - diseases of nervous system exercises judgment: on significance of nervous system for: - correlation between organs and physiological systems; - coordination of body functions with environmental modifications; understands meaning: - <i>contribution of scientists to knowledge of nervous system (I. P. Pavlov, I. M. Sechenov), including Ukrainian scientists (V. O. Bets)</i></p> <p>Practice (skills) recognizes (on pictures and models): - structure of spinal cord; - brain divisions; applies knowledge for: - prevention of nervous diseases; - compliance with work and rest schedule</p>	<p>Nervous system structure. Central and peripheral nervous system. Spinal cord. Brain. Somatic nervous system. Vegetative nervous system Prevention of nervous diseases</p> <p>Laboratory studies Studies of structure of brain and spinal cord (by models and laminated preparations)</p>
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**TOPIC 9. CONNECTION OF HUMAN BODY WITH THE ENVIRONMENT.
SENSORY SYSTEMS
(7 hours)**

<p>Knowledge uses the following terms: - sensory systems, sense organs, receptors names: - main sensory systems; - analyzer structure characterizes: - peculiarities of structure and functions of visual and auditory sensory systems;</p>	<p>General characteristics of sensory systems, their structure. Visual sensory system. Eye. Vision hygiene Auditory sensory system. Ear. Auditory hygiene Sensory systems of balance, smell, motion, touch, temperature, pain</p>
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<p>- sensory systems of balance, smell, motion, touch, temperature, pain; explains: - perceptual experience: light, color, space, sound, smell, taste, balance</p> <p>Practice (skills) recognizes (on pictures and models): - elements of eyes and ear structure makes connection between: structure and functions of eye and ear observes: - blind spot on retina; - accommodation of eye; - changes of auditory sensitivity; - temperature adaptation of skin receptors; applies knowledge for: - prevention of visual and auditory disorders and diseases evaluates: - significance of sensory systems for support of life processes and connection with environment</p>	<p>Demonstration clastic models of eye and ear</p> <p>Laboratory studies: accommodation of eye; determination of blind spot on retina; determination of auditory sensitivity threshold.</p> <p>Research practical work Research of temperature adaptation of skin receptors.</p>
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TOPIC 10. HIGHER NERVOUS ACTIVITY (7 hours)

<p>Knowledge uses the following terms: - inborn reflex, acquired reflex, thinking, speaking, memory names: - <i>nervous processes (excitement and suppression);</i> - variables of nervous processes (strength, mobility, stability); - <i>types of sleep;</i> - reasons of biorhythms; gives examples of: - inborn and acquired reflex; - human biorhythms; characterizes: - peculiarities of higher nervous activity; - instinctive and acquired behavior; - types of learning, types of memory; explains: - significance of second signal system; - role of brain cortex in thinking; - reasons of individual peculiarities of human behavior exercises judgment: - on significance of memory for intellectual development; - on self-education as a part of personality formation; - on impact of social factors on personality formation; - on significance of biorhythms for sleeping and full life; understands meaning: - <i>contribution of scientists to knowledge of higher nervous activity (I. P. Pavlov, I. M. Sechenov, O. O. Ukhtomskiy etc.)</i></p>	<p>Higher nervous activity and its main types Inborn and acquired reflexes Instincts Speaking. Learning and memory Thinking and consciousness. Sleep. Biorhythms</p> <p>Laboratory research: pupillary light reflex; research of memory types.</p> <p>Research practical work Definition of type of higher nervous activity and temperament characteristics</p>
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<p>Practice (skills) distinguishes: - types of higher nervous activity and temperament characteristics; compares: - inborn and acquired reflex; - first and second signal systems; applies knowledge for: - sticking to the rule of intellectual functioning</p>	
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TOPIC 11. ENDOCRINE SYSTEM (3 hours)

<p>Knowledge uses the following terms: endocrine system, hormones, homeostasis names: - vascular and endoexocrine glands; - location of vascular glands in human body; characterizes: - neurohumoral regulation of physiological functions; - impact of hormones on metabolic processes; explains: - role of nervous system in regulations of vascular glands functioning; - role of endocrine system in development of stress reactions; - significance of endocrine system for homeostasis support and organism adaptation make conclusion on: - cooperation of regulatory systems</p> <p>Practice (skills) applies knowledge for: - prevention of iodine deficiency and other diseases caused by endocrine dysfunction</p>	<p>Endocrine system. Vascular and endoexocrine glands. Prevention of diseases of endocrine system. Cooperation of regulatory systems</p> <p>Project. Iodine deficiency in human body, its consequences and prevention (<i>or topic on teacher's choice</i>)</p>
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TOPIC 12. HUMAN REPRODUCTION AND DEVELOPMENT (4 hours)

<p>Knowledge uses the following terms: embryonal development, reproductive cells (spermatozoid, egg), fertilization, zygote, pregnancy, placenta names: - functions of reproductive glands; - primary and secondary sex characters; - periods of human ontogenesis; characterizes: - fertilization process; - embryonic and fetal development; - child development after birth; - functions of placenta; - sexual development; - <i>age periods of personal human development;</i> - peculiarities of adolescence; - sexually transmitted diseases;</p>	<p>Structure and functions of reproductive system. Reproductive cells Fertilization. Menstrual period Pregnancy. Fetal life Placenta and its functions. Postembryonic development Reproductive health</p>
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<p>explains: - <i>significance of endocrine system for regulation of gametogenesis, ovulation, pregnancy, embryonic development;</i> - impact of environmental factors and parents' way of life on fetal development</p> <p>exercises judgment: - on necessity of reproductive health maintenance for youth; - on dependence of unborn child on mother's behavior and health; - on impact of nicotine, tobacco and alcohol on fetal development;</p> <p>evaluates: - significance of personal hygiene for young people;</p> <p>shows attitude towards: - healthy lifestyle as an important condition for delivery of a healthy child</p> <p>Practice (skills)</p> <p>compares: - structure of male and female cells;</p> <p>applies knowledge to: - prevent sexually transmitted diseases and HIV transmission</p>	
CONCLUSION (approximately 1 hour)	
<p>Knowledge</p> <p>names: - functions providing body integrity; - body balance control;</p> <p>characterizes: - integrated function of circulatory, nervous and endocrine systems</p> <p>make conclusion on: - biosocial human origin</p> <p>Practice (skills)</p> <p>explains: - how body integrity is provided</p>	<p>Human body integrity Correlation of regulatory systems</p>

9th form

(70 hours – 2 hours per week, with reserved 2 hours)

Learning outcomes	Syllabus
Introduction (approximately 2 hours)	
<p>Knowledge uses the following terms: - descriptive method. experimental method, modeling names: - main branches of biology; - levels of life arrangement; gives examples of: - biological systems of different levels of life arrangement; explains: - methods of biological research for understanding of nature; - relationship of biology with other sciences and humanities; characterizes: - methods of biological research (descriptive method. experimental method, modeling) understands: distinction between system and its discrete elements and dependency of system functioning from correlation of elements on different levels</p> <p>Practice (skills) applies: - methods of biological research for understanding certain aspects of nature (descriptive method. experimental method, modeling, monitoring, statistical method of data presentation); analyzes and compares: - biological systems of different levels of life arrangement; simulates/models: - simple biological systems of different levels (for example, system of human organs, groups etc.)</p>	<p>Biology as a science. Biology as a subject. <i>Main branches of biology and its place among other sciences.</i> Level of organization of biological systems. Basic methods of biological research.</p>
Topic 1. Chemical composition of cell (8 hours)	
<p>Knowledge uses the following terms: - polymer, protein, nucleid acids, enzyme names: - organic and inorganic substances which make a part of organisms; - constitution of atom (<i>intersubject</i>); - types of chemical bounds (covalent, ionic, hydrogen), hydrophobic interaction (<i>intersubject</i>); describes: - peculiarities and biological role of water, lipids, carbohydrates; - structure, peculiarities and functions of proteins, structural organization of proteins; - structure and functions of nucleic acids; gives examples of: - products containing proteins, lipids and carbohydrates;</p>	<p>Water and its main physical and chemical features. Other inorganic compounds. Organic molecules. Carbohydrates and lipids. Biological macromolecules – biopolymers. Proteins, their structural organization and basic functions. Enzymes and their function for cell. Nucleic acids. Nucleic acids as a source of genetical information. ATP.</p> <p>Laboratory studies: Peculiarities of enzymes. Practical works</p>

<p>explains:</p> <ul style="list-style-type: none"> - <i>significance of external energy sources for biological systems;</i> - significance of ATP for vital functions of organisms; - significance of proteins for vital functions of organisms; - significance of nucleic acids for genetics <p>expresses and proves judgments:</p> <ul style="list-style-type: none"> - on common composition and separate content of chemical elements for animate and inanimate nature; - on significance of different products for human ration; <p>make conclusion on:</p> <ul style="list-style-type: none"> - necessity of eating various food; - significance of modeling for chemical composition of living organisms; <p>understands meaning:</p> <ul style="list-style-type: none"> - <i>contribution of scientists to biochemistry development (I. F. Mischer, F. Crick, J. Watson, R. Franklin etc.), including Ukrainian scientists (O.V. Palladin, O. V. Danylevskiy, Ya. O. Parnas)</i> <p>Practice (skills)</p> <p>recognizes:</p> <ul style="list-style-type: none"> - examples of organic substances by name; <p>explores / observes:</p> <ul style="list-style-type: none"> - examples of enzymosis environment; <p>solves:</p> <ul style="list-style-type: none"> - elementary exercises on molecular biology on structure of proteins and nucleic acids; <p>analyzes and compares:</p> <ul style="list-style-type: none"> - structural organization of proteins; - peculiarities of organic molecules 	<p>No 1. Elementary exercises on structure of proteins and nucleic acids</p>
<p>Topic 2. Cell structure (6 hours)</p>	
<p>Knowledge</p> <p>uses the following terms:</p> <ul style="list-style-type: none"> - eukaryotes, prokaryotes, viruses, cell organization, cytoplasm, endoplasmic reticulum, Golgi body, lysosome, tonoplast, cytoskeleton <p>names:</p> <ul style="list-style-type: none"> - <i>methods of cell research;</i> - cytoplasm components; - main cell organelles and their functions; - basic components and functions of cell nucleus; <p>gives examples of:</p> <ul style="list-style-type: none"> - eucaryotic and procaryotic organisms; - movements of cell and intracellular trafficking; <p>recognizes:</p> <ul style="list-style-type: none"> - cell components of schemes and electronic microphotographs; <p>explains:</p> <ul style="list-style-type: none"> - significance of membrane for cell vital functions; - correlation of cells with the environment; <p>characterizes:</p> <ul style="list-style-type: none"> - chemical composition of cell membrane <p>exercises judgment:</p>	<p><i>Methods of cell research.</i></p> <p>Microscopy types.</p> <p>Structure of eukaryotic cell: cell membrane, cytoplasm and main cell organelles.</p> <p>Cell nucleus, its structural organization and functions.</p> <p>Types of cell and their comparative characteristics: eucaryotic and procaryotic cell, plant and animal cell.</p> <p>Demonstration of patterns illustrating cell structure, slides of plant and animal cells.</p> <p>Laboratory works</p> <p>1. Study of structural and functional variety of cells.</p>

<p>- on significance of cell as an elementary structural unit of living systems; understands meaning: - <i>contribution of scientists to knowledge of cell (T. Schwann, M. Schleiden, K. Goldgi etc.)</i></p> <p>Practice (skills) compares: - cell structure of eukaryotes and prokaryotes; - cell structure of plants, animals, fungi; stick to the rules of: - preparation of slides and their examination through a microscope; - drawings of biological objects; observes: - elements of cell structure on permanent and temporary slides; analyzes: - correlation between structure and functions of organelles; - correlation between structure and functions cell nucleus</p>	
Topic 3. Principles of cell functioning (6 hours)	
<p>Knowledge uses the following terms: - metabolism, cell respiration, mitochondria, photosynthesis, plastid, chemosynthesis names: - process of metabolism and energy change in cell cytoplasm; - cell organelles with respiration and photosynthesis; gives examples of: - partition processes of organic substances in cell exercises judgment: - on significance of photosynthesis, chemosynthesis, cell respiration for providing body energy needs; - on planetary significance of photosynthesis; applies knowledge on: - cell vital processes for motivation of healthy lifestyle; make conclusion on: - similarity of metabolism processes in cells of different groups of organisms; - on significance of modeling in cell processes research</p> <p>Practice (skills) characterizes: - processes of photosynthesis and cell respiration as a source of energy for cells; analyzes: - impact of external factors on cell processes (namely cause of green color of plants); compares: - processes of photosynthesis, chemosynthesis</p>	<p>Metabolism and energy change. <i>Main ways of partition of organic substances in living organisms.</i> Cell respiration. <i>Biochemical mechanisms of respiration.</i> Photosynthesis: light-dependent and light-independent reactions. Chemosynthesis. <i>Main principles of synthetic processes in cells and organisms.</i></p>
Topic 4. Preservation and realization of genetic information (11 hours)	
<p>Knowledge uses the following terms:</p>	<p>Genes and genomes. <i>Genes structure and main</i></p>

<p>- gene, genetic code, nucleus, chromosome, Paladeses granule, transcription, translation, mitosis, meiosis</p> <p>names:</p> <ul style="list-style-type: none"> - gene types; - stage of realization of genetic information; = - phases of mitosis and meiosis; - <i>ontogenesis periods for multi-cellular organisms;</i> <p>gives examples of:</p> <ul style="list-style-type: none"> - application of nucleotide complementarity principle <p>make conclusion on:</p> <ul style="list-style-type: none"> - on significance of cell generic apparatus; <p>Practice (skills)</p> <p>characterizes:</p> <ul style="list-style-type: none"> - transcription process; - process of protein biosynthesis ; - process of DNA replication; - genetic code and its significance for protein biosynthesis; - correlation between chromosome structure and functions; - mitosis and meiosis processes for eukaryotes; - stages of cellular cycle; - <i>ontogenesis stages of plants and animals;</i> <p>compares:</p> <ul style="list-style-type: none"> - transcription and replication processes; - mitosis and meiosis processes 	<p><i>components of genomes of prokaryotes and eukaryotes.</i></p> <p>Transcription.</p> <p>Main types of RNA.</p> <p>Genetic code. Protein biosynthesis.</p> <p>DNA duplication; <i>reparation of DNA damage.</i></p> <p>Cell division: cellular cycle, mitosis. Meiosis. DNA recombination</p> <p>Reproductive cells and fertilization. <i>Stages of individual development.</i></p> <p>Laboratory studies:</p> <p>phases of mitosis (as exemplified by cells of onion root).</p> <p>Practical works</p> <p>1. Elementary exercises on replication, transcription and translation</p>
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Topic 5. Common factors of features inheritance (10 hours)

<p>Knowledge</p> <p>uses the following terms:</p> <ul style="list-style-type: none"> - allele, genotype, phenotype, mutation (point, chromosome, genome mutations), mutagene <p>names:</p> <ul style="list-style-type: none"> - methods of genetic research; - Mendel's laws; - variation forms; - mutagenic agents; - mutation types; - <i>genetic linkage in chromosomes;</i> <p>gives examples of:</p> <ul style="list-style-type: none"> - hereditary variation; - in hereditary variation; - genetic disorders; <p>explains:</p> <ul style="list-style-type: none"> - concepts: dominant and recessive alleles, homozygote, heterozygote; - significance of genotype and environmental conditions for phenotype formation; <p>exercises judgment:</p> <ul style="list-style-type: none"> - on significance of and molecular diagnostic methods for modern genetics; - on impact of parents' bad health habits on children (smoking, alcohol consumption, drug abuse); <p>understands meaning of:</p> <ul style="list-style-type: none"> - <i>contribution of scientists to knowledge of genetics (G. Mendel,</i> 	<p>Classical methods of genetic research. Genotype and phenotype. Alleles. Mendel's laws.</p> <p><i>Trait as a result of gene interaction.</i></p> <p><i>Genetic linkage and crossing over.</i></p> <p>Genetics of sex and sex-linked inheritance.</p> <p>Variation forms.</p> <p>Mutation: mutation types, reasons and consequences.</p> <p>Genetic diseases.</p> <p>Genetic counselling.</p> <p><i>Modern methods of molecular genetics.</i></p> <p>Demonstration of</p> <p>crossing schemes illustrating main genetic patterns.</p> <p>Laboratory studies</p> <p>variation of plants and animals.</p> <p>Practical works</p> <p>2. Drawing crossing schemes.</p> <p>Project</p> <p>Drawing genealogical trees and demonstration of inheritance of certain traits (on pupil's choice) /</p>
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<p><i>T. H. Morgan etc.), including Ukrainian scientists (S.M. Gershenzon)</i></p> <p>Practice (skills) applies knowledge: - for composition of crossing schemes - for evaluation of inherited characters in family and family planning; - for argumentation of protective measures of mutagenic agents impact;</p> <p>characterizes: - sex-linked inheritance; - variability: combinative, mutational, modification; - limitations of diagnosis of hereditary diseases;</p> <p>compares: - mutational and modification variability; - inheritance of dominant and recessive traits;</p> <p>stick to the rules of: - drawing genealogical trees;</p> <p>applies knowledge: - for evaluation of inherited characters in family and family planning</p>	<p>genealogical trees of prominent people (on pupil's choice)</p>
<p>Topic 6. Organic evolution (7 hours)</p>	
<p>Knowledge uses the following terms: - species, population, evolution, natural selection, anthropogenesis</p> <p>gives definitions: - convergence, divergence, parallelism;</p> <p>explains: - basic concepts of current Theory of Evolution; - population as elementary unit of evolution; - basic characteristics of population; - elementary factors of evolution; - species criteria; - ways of speciation; - evidence for evolution; - types of natural selection; - different views on advent of life on Earth (creationism, spontaneous generation, biochemical evolution, panspermic theory); - human evolution stages; - variety of organisms <i>as a result of evolution</i>;</p> <p>gives examples of: - adaptation of organisms to environmental conditions; - ichnolites of different geological epochs;</p> <p>exercises judgment: - on correlation of biological and socio-cultural factors of human development;</p> <p>make conclusion on: - unity of organic world showing in its variety; - significance of modeling in research of evolutionary processes on different levels;</p> <p>understands meaning: - <i>contribution of scientists to evolutionism (E. Haeckel, Ch. Darwin, J.-B. Lamarck etc.), including Ukrainian scientists (O. O. Kovalevskiy)</i></p>	<p>Population of living organisms and their main characterizes. Evolutionary factors. <i>Mechanism of primary evolutionary changes.</i> Speciation mechanisms. <i>Development of evolutionary opinions.</i> Darwinian theory. Role of paleontology and <i>molecular genetics</i> for evolution theory. Human evolution. Stages of human evolution. Ideological and scholarly views on origin and historical development of life.</p>

<p>Practice (skills) characterizes: - development of views on origin of variety of living things; compares: - geographical and ecological speciation; stick to the rules of: - drawing up elementary tables, schemes demonstrating evolutionary development of flora and fauna on the Earth</p>	
Topic 7. Biological diversity (optional, 4 hours)	
<p>Knowledge names: - taxonomic units; - main groups of organisms make conclusion on: - unity of organic world showing in its variety; understands: - significance of different life forms for maintaining human health</p> <p>Practice (skills) characterizes: - basic principles of biological systematics; analyzes and compares: - means of disease control (viral diseases, bacterial diseases, protozoal diseases etc.)</p>	<p><i>Principles of evolutionary genealogy and systematics.</i> <i>Main groups of organisms: bacteria, archaea, eukaryote.</i> <i>Noncellular life forms: viruses.</i> <i>Overview of main eukaryotic taxonomic units.</i></p>
Topic 8. Supraorganismal biological systems (7 hours)	
<p>Knowledge uses the following terms: - ecological factors, producers, consumers, decomposers, ecosystem, food chain (web), biosphere names: - research methods of ecosystem processes; - ecological factors; gives examples of: - groups, ecosystem; - adaptation of organisms to environmental conditions; - food chains; explains: - ecosystem structure; - cooperation of organisms in ecosystems; - structure of food chains; - rule of ecological pyramid; - significance of circuit of substance to save ecosystem; - functional components of biosphere; - significance of nature reserves to save biological variety and balance in biosphere; compares: - natural and man-made ecosystems; - role of producers, consumers and decomposers in natural and man-made ecosystems; make conclusion on:</p>	<p>Ecosystem. Variety of ecosystems. Trophic connections, energy flows and circuit of substance in ecosystems. Biotic, abiotic and anthropic (anthropogenic, technogenic) factors. Stability of ecosystem and reasons of destabilization. Biosphere as a united system. Protection and preservation of biosphere, core measures of environmental protection. Project (research) Determination of anthropogenic and technogenic impact on ecosystems of locality.</p>

<ul style="list-style-type: none"> - unity and self-regulation of living system; - on significance of nature group to save biosphere balance; understands meaning: - <i>contribution of scientists to ecology development (E. Haeckel, J. Liebig, E. Shelford etc.), including Ukrainian scientists (M. I. Vernadskiy);</i> forming civil attitude: - to protect environment <p>Practice (skills)</p> <p>applies knowledge:</p> <ul style="list-style-type: none"> - on peculiarities of functioning of populations, ecosystems, biosphere for their protection; forecasting human impact on ecosystems, taking control over own behavior in modern ecosystems; <p>recognizes:</p> <ul style="list-style-type: none"> - main groups of organisms according to their ecological role in ecosystem food webs; <p>applies knowledge:</p> <ul style="list-style-type: none"> - to arrange food chains (webs) in ecosystems; <p>stick to the rules of:</p> <ul style="list-style-type: none"> - drawing up ecological pyramids of different types; <p>observes:</p> <ul style="list-style-type: none"> - impact of ecological factors on different groups of organisms; <p>analyzes and compares:</p> <ul style="list-style-type: none"> - different life environments; - natural and man-made ecosystems; <p>describes:</p> <ul style="list-style-type: none"> - anthropic impact on nature ecosystems; <p>take part in nature protection activities and is committed to environmental culture in everyday life</p>	
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Topic 9. Biology as a basis for biotechnology and medicine (6 hours)

<p>Knowledge</p> <p>uses the following terms:</p> <ul style="list-style-type: none"> - biotechnology, selection, genetic engineering, genetically modified organisms <p>names:</p> <ul style="list-style-type: none"> - selection methods; - tasks and principal directions of modern biotechnology; - methods of modern biotechnology; - limitations of diagnosis of hereditary diseases; <p>explains:</p> <ul style="list-style-type: none"> - advantages and risks of using genetically modified organisms; <p>gives examples of:</p> <ul style="list-style-type: none"> - substance (products), delivered by methods of traditional biotechnologies; - substance (products), delivered by methods of genetic engineering <p>applies knowledge to evaluate:</p> <ul style="list-style-type: none"> - possible negative and positive consequences of using modern biotechnologies; <p>exercises judgment:</p> <ul style="list-style-type: none"> - on using genetically modified organisms; - on moral and social aspects of biological research 	<p>Selection. Introduction to cropping. <i>Methods of plant selection.</i> Domestication. <i>Methods of animal selection.</i> Overview of traditional biotechnologies. Principles of genetic and cellular engineering, Role of genetic engineering in modern biotechnologies and medicine. Genetically modified organisms</p>
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<p>Practice (skills) compares: <i>- classic methods of selection and modern biotechnical approaches</i></p>	
<p>Conclusion</p>	
<p>Knowledge uses the following terms: - system make conclusion on: - on unity of living systems on different levels</p> <p>Practice (skills) characterizes: - basic general characteristics of living systems</p>	<p>Basic general characteristics of living systems</p>