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***Департамент за езиково и  
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## **Section of Natural Sciences**

### **PROGRAM**

**Biology for preparing year foreign students in Medicine, Dental Medicine and  
Pharmacy**



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**Approved by the Departmental Council on 14 January, 2021/**

**Proceedings № 1**

**Section of Natural Sciences - Biology**

**Course name:**

Biology for preparing year foreign students in Medicine, Dental Medicine and Pharmacy

**Type of course according to the Uniform State Requirements:**

Mandatory

**Level of Education:**

Preparatory course

**Form of Education:**

Lecture exercises, Seminars

**Duration of the education:**

Two semesters, 27 weeks

**Auditorium classes:**



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170 hours

**Technical equipment applied in the training:**

Multimedia presentations, anatomical skeleton, Anatomy atlases, drawings, tests, specialized dictionaries with medical and biological terminology.

**Control and evaluation:**

- Ongoing evaluation – weekly tests, oral examinations, colloquium
- Final evaluation – combined written test.

**Formation of the final grade:**

The final grade is based on the mark from the final combined test exam.

**Aspects in the formation of the final grade:**

Participation in seminars, results from test exams, colloquium and final exam

**Semester exam:**

Yes/Written examination

**State exam:**

No

**Lecturer:**

Leading teacher from Natural Sciences section

**Section:** Natural Sciences



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## ANOTATION

The discipline Biology allows students from preparatory course to acquire knowledge and skills in the following basic biological concepts:

- selected and adapted minimum of medical and biological terminology
- scientific vocabulary in disciplines cytology, histology, anatomy, physiology, molecular and cell biology, immunological homeostasis

The following methods of education are used:

- Methods for building verbal communication skills using medical-biological terminology and scientific vocabulary
- Methods for control and evaluation of the knowledge
- Methods of communicative competence of the disciplines studied
- Inductive, deductive, interdisciplinary and integral approach
- Motivational approach

## COURSE TASKS

The main tasks of the curriculum are determined by the program and content of the medical and biological disciplines studied in the first and second year in Medicine, Dental Medicine and Pharmacy. The aim is to acquire the knowledge and skills needed in the next level of training. The tasks are as follows:



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- Undergraduate level of biology knowledge in English to enable students to participate fully in the initial stage of the educational process in the respective faculty
- A free use of biological terminology in English and understanding the specifics of the scientific style
- Professional orientation training
- Education in humane principles
- Targeted education of friendly relationships in order to increase the effectiveness of the learning process

## **OBLIGATORY COMPETENCIES**

### 1. Theoretical knowledge:

- to have communicative competence and to be able to apply knowledge in order to understand the information in first and second year of education
- to be able to understand and analyze the medical and biological texts in English on the disciplines studied
- to know and apply modern methods and tools for biology education
- to know and apply methods for their personal improvement
- to know and use the scientific style in the medical-biological disciplines studied
- to cover the exam and test requirements



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**CURRICULUM**

Type of courses	Course hours				Total
	Exercise duration	Weekly	I semester	II semester	
Lecture exercises and seminars	2 or 3	6 or 7	68	102	170

**PROGRAM**

Biology 2020/2021		
I semester (11 weeks)		
Introductory course – 20 h		
		Hours
Cell 1		2
Cell 2		2
Tissues		2
Organs and Systems 1		2
Organs and Systems 2		2



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	Organs and Systems 3	2
	Organism Properties - Life Processes	2
	Relationships between the organisms	2
	Exercises	2
0	Test № 1	2
	<b>General lessons - 150 h</b>	
1	The Cell – the first level of the structural organization of the human organism	2
2	Tissues. Tissue Types: epithelial, connective. Characteristics, classification, functions	2
3	Tissues. Tissue Types: muscle, nervous. Characteristics, classification, functions	2
4	The organism as an integral unit. Structural organization of the human organism	2
5	Digestive system. Nutrition	2
6	Digestive system. Digestion in the mouth	2
7	Digestive system. Digestion in the stomach and intestines	2



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8	Hygiene of nutrition. Health related knowledge about the digestive system	2
9	Respiratory system. Nose, pharynx, larynx, trachea, lungs	2
0	Respiratory system. Respiration	2
1	Hygiene and health related knowledge about the respiratory system	2
2	Exercises and Preparation for a Test	2
3	Test № 2	2
4	Urinary system. Excretion	2
5	Hygiene and health related knowledge about the urinary system	2
6	Cardiovascular system. Heart and blood vessels	2
7	Cardiovascular system. Blood	2
8	Cardiovascular system. Heart activity. Blood circulation	2





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9	Immunity	2
0	Hygiene and health related knowledge about the cardiovascular system. Human Metabolism	2
1	Seminar	2
2	Exercises and Preparation for a Test	2
3	Test № 3	2
4	Locomotive system. Structure of bones and joints. Skull	2
5	Locomotive system. Vertebral column, chest and limbs	2
6	Locomotive system. Muscles. Body movement and support	2
7	Reproductive system. Male reproductive system	2
8	Reproductive system. Female reproductive system	2
9	Fertilization. Embryonic and postnatal development. Reproductive system and development	2



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0	Exercises and Preparation for a Test	2
1	Test № 4	2
2	Nervous system. Spinal cord	2
3	Nervous system. Brain	2
4	Nervous system. Cerebrum	2
5	Nervous system. Autonomic nervous system	2
6	Endocrine system. Pituitary gland, epiphysis, thyroid gland, parathyroid glands	2
7	Endocrine system. Pancreas, adrenal glands, sex glands	2
8	Exercises and Preparation for a Test	2
9	Test № 5	2
0	Sensory systems. Visual sensory system	2



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1	Sensory systems. Auditory, balance, taste, olfactory sensory systems, system of common sensitivity	2
2	Skin. Human organism. Structure and vital processes	2
3	Exercises and Preparation for a Colloquium	2
4	Colloquium	2
5	Chemical composition of the cell	2
6	Carbohydrates and lipids	2
7	Proteins	2
8	Enzymes	2
9	Nucleic acids. Chemical composition of the living matter	2
0	Supramolecular complexes. Viruses.	2
1	Cell – the basic unit of the living matter	3



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2	Prokaryotic cell	2
3	Eukaryotic cell	2
4	Cell membrane	3
5	Non-membrane bound and single-membrane bound organelles	2
6	Double-membrane bound organelles	2
7	Nucleus	3
8	Exercises and Preparation for a Test	2
9	Test № 6	2
0	Genetic processes. Doubling of genetic information. Replication	3
1	Realization of the genetic information. Transcription and translation. Cell structure and cellular processes	2
2	Cell division. Amitosis and mitosis	2



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3	Cell division. Meiosis	3
4	Cell cycle and cell differentiation. Cell reproduction	2
5	Application of the cell knowledge in science and practice	2
6	Exercises and Preparation for a Test	3
7	Test № 7	2
8	Exercises and Preparation for the Entrance Exam	2
9	Exercises and Preparation for the Entrance Exam	3
0	Exercises and Preparation for the Entrance Exam	2
1	Exercises and Preparation for the Final Exam	3



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**LECTURE EXERCISE COURSE SYNOPSIS**

**2020/2021**

**I SEMESTER - 11 WEEKS**

**LESSON 1 – 2 hours. Introductory Course. Cell 1**

Cell organelles. Double membrane organelles, single membrane organelles, non-membrane organelles – terminology.

**LESSON 2 – 2 hours. Introductory Course. Cell 2**

Cell organelle functions. Chemical compound of the cell: organic and neorganic substances – terminology.

**LESSON 3 – 2 hours. Introductory Course. Tissues**

Epithelial, connective, muscular and nervous tissue - terminology

**LESSON 4 – 2 hours. Introductory Course. Organs and Systems 1**

Locomotive system. Digestive system. Cardiovascular system – terminology.

**LESSON 5 – 2 hours. Introductory Course. Organs and Systems 2**



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Respiratory system, Excretory system, Reproductive system, Endocrine system – terminology.

**LESSON 6 – 2 hours. Introductory Course. Organs and Systems 3**

Nervous system, Sensory systems – terminology.

**LESSON 7 – 2 hours. Introductory Course. Organism Properties - Life Processes**

Feeding (Nutrition), Respiration, Excretion, Growth, Reproduction, Movement, Responsiveness, Variation, Heredity – definitions.

**LESSON 8 – 2 hours. Introductory Course. Relationships between the Organisms**

Symbiosis, Synnecrosis, Commensalism, Amensalism, Parasitism, Mutualism – definitions, examples.

**LESSON 9 – 2 hours. Introductory Course. Seminar**

Cell – terminology. Organs and systems – terminology. Organism properties – definitions. Relationships between the organisms – definitions.

**LESSON 10 – 2 hours. Introductory Course. Test № 1**

Cell – terminology. Tissues, organs and systems – terminology. Organism properties – definitions. Relationships between the organisms – definitions.



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**LESSON 11 – 2 hours. The Cell – the first level of the structural organization of the human organism**

Cell – smallest living system in nature. Chemical composition of cells. Structure of the cell. Cell division

**LESSON 12 – 2 hours. Tissues. Tissue Types: epithelial, connective. Characteristics, classification, functions**

Tissues. Tissue types – classification. Epithelial tissue. Surface (simple, stratified) and Glandular epithelium. Secretions – types. Connective tissue – general characteristics. Specialized connective tissues: reticular, loose, adipose, blood, bone, cartilaginous tissue.

**LESSON 13 – 2 hours. Tissues. Tissue Types: muscle, nervous. Characteristics, classification, functions**

Muscle tissue – general characteristics. Smooth, striated and cardiac muscle tissue. Nervous tissue – general characteristics. Nervous cells: neurons and neuroglial cells. Synapses and neurotransmitters

**LESSON 14 – 2 hours. The organism as an integral unit. Structural organization of the human organism**

Structural levels of biological organism: cells, tissues, organs, systems, organism. Regulation and coordination of body functions





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**LESSON 15 – 2 hours. The digestive system. Nutrition**

Nutrition as a major vital process. Nutrients: proteins, carbohydrates, lipids, water, mineral salts, vitamins

**LESSON 16 – 2 hours. The digestive system. Digestion in the mouth.**

Digestion. Digestion in the mouth. Oral cavity. Tongue – structure and function. Teeth – structure and function. Deciduous and permanent teeth. Teeth types: incisors, canines, molars, premolars. Wisdom teeth. Salivary glands and saliva. Enzymes. Pharynx – structure and function. Oesophagus– structure and function. Peristalsis. Regulation of digestion in the mouth.

**LESSON 17 – 2 hours. Digestive system. Digestion in the stomach and intestines**

Stomach – structure and function. Stomach juice – enzymes. Small intestine – structure and function. Intestinal juice – enzymes. Pancreas – structure and function. Pancreatic juice – enzymes. Liver – structure and function. Gall bladder – structure and function. Bile. Absorption. Large intestine – structure and function. Regulation of digestion in the stomach and intestines

**LESSON 18 – 2 hours. Hygiene of nutrition. Health related knowledge about the digestive system**

Hygienic rules and norms. Dietary regime. Hygiene and preparation of food. Hygiene of the digestive system. Food poisoning, tooth diseases, gastritis, ulcer, hepatitis, cirrhosis, colitis, appendicitis, obesity, wasting syndrome

**LESSON 19 – 2 hours. Respiratory system. Nose, pharynx, larynx, trachea, lungs**



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Respiratory system. Breathing passages (respiratory pathways): Nose, nasal cavity, olfactory organ, larynx, vocal cords, vocal gap, trachea, bronchi, bronchioles. Organs of gas exchange: lungs, pleura, alveoli.

**LESSON 20 – 2 hours. Respiratory system. Respiration**

Respiratory movements: inspiration (inhalation) and expiration (exhalation). Vital capacity. Breathing (respiratory) rate. Gas exchange in the lungs. Gas exchange in the tissues. Regulation of breathing

**LESSON 21 – 2 hours. Hygiene and health related knowledge about the respiratory system**

Hygienic rules and norms. Excessive intake of foods rich in fats and carbohydrates. Sports and hiking in nature. Content of the air. Cigarette smoke and smoking. Common cold, influenza (Flu), tonsillitis, laryngitis, tracheitis, bronchitis, bronchial asthma, pneumonia, lung tuberculosis, lung cancer.

**LESSON 22 – 2 hours. Exercises and Preparation for a Test**

Tissues. Digestive and respiratory systems

**LESSON 23 – 2 hours. Test № 2**

Tissues. Digestive and respiratory systems



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**LESSON 24 – 2 hours. Urinary system. Excretion**

Excretory system. Kidney structure: cortex, medulla and pelvis. Nephron. Malpighian body structure: glomerulus, renal capsule, convoluted canal. Collecting duct. Ureter, urinary bladder, urethra – structure and function. Urine production: filtration, selective reabsorption, secretion. Regulation of excretion

**LESSON 25 – 2 hours. Hygiene and health related knowledge about the urinary system**

Kidney disorder and insufficiency. Haemodialysis and dialysis machine. Kidney stones, glomerulonephritis, pyelonephritis, cystitis, urethritis.

**LESSON 26 – 2 hours. Cardiovascular system. Heart and blood vessels**

Heart structure: chambers – right and left atria, right and left ventricles; valves – atrioventricular and semilunar valves; layers – epicardium, myocardium, endocardium. Pericardium. Blood vessels. Arteries and arterioles. Arterial wall structure. Veins and venules. Venous wall structure. Capillaries. Blood supply of the heart wall

**LESSON 27 – 2 hours. Cardiovascular system. Blood**

Blood. Blood plasma. Blood clotting (coagulation). Blood cells: erythrocytes, leucocytes, thrombocytes. Blood groups. Blood group antigens. Blood group antibodies. Rhesus factor. Agglutination.

**LESSON 28 – 2 hours. Cardiovascular system. Heart activity. Blood circulation**



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Heart function. Cardiac cycle. Systole and diastole. Heart rate. Pulse. Heart sounds. Blood pressure. Systemic and pulmonary circulation. Systemic circulation: left ventricle – aorta – body – venae cavae – right atrium. Pulmonary circulation: right ventricle – pulmonary artery – lungs – pulmonary veins – left atrium. Regulation of blood circulation. Internal liquid environment of the body. Lymph. Lymph circulation. Tissue liquid

**LESSON 29 – 2 hours. Immunity**

Immunity. Innate and acquired immunity. Antigens and antibodies. Vaccination and immunisation. Allergies

**LESSON 30 – 2 hours. Hygiene and health related knowledge about the cardiovascular system. Human Metabolism**

Hygienic rules and norms. Living conditions and lifestyle leading to social diseases: training of the heart muscle, diet, chemical factors, risk situations leading to blood-borne infections, stress and fatigue. Hypotension, hypertension, atherosclerosis, myocardial infarction (heart attack), brain insult (stroke), leukemia

**LESSON 31– 2 hours. Seminar**

Tissues. Digestive, respiratory, excretory and cardiovascular systems

**LESSON 32 – 2 hours. Exercises and Preparation for a Test**

Excretory and cardiovascular systems



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**LESSON 33 – 2 hours. Test № 3**

Excretory and cardiovascular systems

**LESSON 34 – 2 hours. Locomotive system. Structure of bones and joints. Skull**

Composition and structure of bones. Shape of bones: long, short, flat and irregular bones. Growth of bones. Bone connections: immobile, semi-mobile and mobile (joints). Skeleton. Bones of the Skull: cerebral (cranial) and facial bones

**II SEMESTER – 16 WEEKS**

**LESSON 35 – 2 hours. Locomotive system. Vertebral column, chest and limbs**

Vertebral column. Vertebral column shape and functions. Vertebra – structure. First and second vertebrae: atlas, axis. Vertebral types: cervical, thoracic, lumbar. Sacral bone. Coccygeal bone. Rib cage. Rib cage shape and functions. Rib cage structure: breast bone, ribs, thoracic vertebrae. Types of ribs: true, false and floating. Bones of the upper limb. Shoulder girdle: clavicle, shoulder blade; Free upper limb: arm – humerus; forearm – ulna, radius; hand – wrist bones, metacarpals, phalanges. Joints: shoulder, elbow and wrist joints. Bones of the lower limb. Pelvic girdle: hip bone – ilium, ischium, pubis; Free lower limb: thigh – femur; patella; leg – tibia, fibula; ankle – tarsal bones; foot – metatarsal bones, phalanges. Joints: hip, knee and ankle joints.



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**LESSON 36 – 2 hours. Locomotive system. Muscles. Body movement and support**

Skeletal muscles. Muscle structure. Muscle types: fusiform, flat and circular; flexors, extensors, abductors, adductors. Muscles of the head: for facial expression, for mastication; neck and trunk: abdominal, breast spine muscles. Muscles of the upper limb. Muscles of the lower limb. Action of muscles. Function of muscles. Muscle tone. The physiological properties of muscles. Muscle strength. Muscle work. Locomotive System and Health: scoliosis, discopathy, splayfoot, osteoporosis.

**LESSON 37 – 2 hours. Reproductive system. Male reproductive system**

Male reproductive system: Testes, epidimides, sperm ducts (vasa deferentia), seminal vesicles, prostate gland, penis, scrotum – structure and function. Erection and ejaculation.

**LESSON 38 – 2 hours. Reproductive system. Female reproductive system**

Female reproductive system: ovaries, uterine tubes (oviducts), uterus, vagina, hymen, clitoris, large and small labia, mammary glands – structure and function. Ovulation and menstruation. Gametes and sex hormones. Sexual and Reproductive Health

**LESSON 39 – 2 hours. Fertilization. Embryonic and postnatal development.  
Reproductive system and development**

Fertilization. Embryonic development. Birth. Postnatal development: newborn period, breastfeeding period, early childhood, preschool age, school age and puberty, adulthood, old age, death.



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**LESSON 40 – 2 hours. Exercises and Preparation for a Test**

Locomotive and reproductive systems

**LESSON 41 – 2 hours. Test № 4**

Locomotive and reproductive systems

**LESSON 42 – 2 hours. Nervous system. Spinal cord**

Nervous system. General Structure and Principles of Activity. Spinal cord structure: white and grey matter, afferent and efferent nerve bundles. Spinal nerves structure: anterior (motor) and posterior (sensitive) roots, afferent and efferent fibers, insulation layer – myelin sheath. Spinal cord functions: transmitting and reflexive. Reflex arc: receptor, sensory nerve, nervous center, motor nerve, reacting organ (effector).

**LESSON 43 – 2 hours. Nervous system. Brain**

Brain structure. Brain stem: medulla oblongata, pons, mesencephalon(midbrain),. Cerebellum. Diencephalon: thalamus, hypothalamus. Cranial nerves

**LESSON 44 – 2 hours. Nervous system. Cerebrum**

Cerebrum (telencephalon): right and left hemisphere, cortex, corpus callosum, brain ventricles, meninges, cerebrospinal liquid. Frontal, temporal, parietal and occipital lobes. Brain functions. Motor, common sensitivity, taste, visual, auditory and vestibular areas. Higher nervous activity. Unconditioned and conditioned reflexes



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**LESSON 45 – 2 hours. Nervous system. Autonomic nervous system**

Autonomic nervous system structure: sympathetic and parasympathetic parts.  
Autonomic nervous system function. Hypothalamic control of the autonomic nervous system.

**LESSON 46 – 2 hours. Endocrine system. Pituitary gland, epiphysis, thyroid gland, parathyroid glands**

Endocrine System – structure and functions. Hormonal regulation – negative feedback. Pituitary gland. Hormones of the anterior part. Hormones of the posterior part. Thyroid gland. Epiphysis (pineal gland). Parathyroid glands. Endocrine system and health. Hypofunction and hyperfunction of the gland.

**LESSON 47 – 2 hours. Endocrine system. Pancreas, adrenal glands, sex glands**

Endocrine System. Pancreas. Adrenal (suprarenal) glands. Sex glands. Hormones and effects. Endocrine system and health. Hypofunction and hyperfunction of the glands.

**LESSON 48 – 2 hours. Exercises and Preparation for a Test**

Endocrine and nervous systems.

**LESSON 49 – 2 hours. Test № 5**

Endocrine and nervous systems





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**LESSON 50 – 2 hours. Sensory systems. Visual sensory system**

General structure and functions of the sensory systems: peripheral (sensory organs), conductive (sensory nerves) and cortical (sensory areas in the cortex). Visual sensory system. Human eye – structure and function.

**LESSON 51 – 2 hours. Sensory systems. Auditory, balance, taste, olfactory sensory systems, system of common sensitivity**

Sensory Systems. Auditory sensory system: external, middle and inner ear, organ of Corti. Vestibular (balance) sensory system: vestibular apparatus. Gustatory (taste) sensory system: tongue taste receptors (buds). Olfactory (smell) sensory system: olfactory organ. Somatosensory system: receptors for heat/cold, pain, touch, pressure, vibration. Kinesthetic sensory system.

**LESSON 52 – 2 hours. Skin. Human organism. Structure and vital processes**

Skin. Skin layers: epidermis, dermis, hypodermis. Sweat glands – structure and functions. Sebaceous (oil) glands - structure and functions. Hairs and nails. Skin functions: protective, thermoregulative, sensory, excretory, respiratory, reserve function. Skin hygiene

**LESSON 53 – 2 hours. Exercises and Preparation for a Colloquium**

Cells, tissues, organs and systems

**LESSON 54 – 2 hours. Colloquium**



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Cells, tissues, organs and systems

**LESSON 55 – 2 hours. Chemical composition of the cell**

Chemical elements in the cell: macro-, oligo- and microelements. Chemical compounds in the cell: organic and inorganic compounds. Monomers and polymers (biopolymers). Water in the cell. Structure of the water molecule. Properties of water. Biological functions of water. Mineral salts

**LESSON 56 – 2 hours. Carbohydrates and lipids**

Carbohydrates: monosaccharides, oligosaccharides, polysaccharides. Solubility and properties of carbohydrates. Glycogen, starch, cellulose. Lipids: fatty acids, fats, triglycerides, phospholipids, steroids, carotenoids, waxes

**LESSON 57 – 2 hours. Proteins**

Protein structure: amino acids, polypeptide chains. Levels of organization of proteins: primary, secondary, tertiary and quaternary structure. Protein functions: structural, catalytic, regulative, transport, active and passive protective, contractile, receptor and energy source. Shape of the protein molecule. Protein properties: denaturation and renaturation

**LESSON 58 – 2 hours. Enzymes**

Enzymes. Properties of enzymes. Nature of enzymes: one component and two component enzymes. Mechanism of enzyme action. Factors affecting the enzyme activity: temperature, acidity of the medium, substrate concentration, activators and inhibitors. Practical application of the enzymes



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**LESSON 59 – 2 hours. Nucleic acids. Chemical composition of the living matter**

Nucleic acids. Polynucleotide chains. Nucleotide (monomer) structure: pentose sugar, phosphate acid residue and nitrogen base. DNA structure – double helix. DNA – main hereditary molecule. Genetic code. Structure of RNA– single stranded. The monomer of RNA: ribonucleotide. Main RNA types. Messenger RNA (mRNA). Transfer RNA (tRNA). Ribosomal RNA (rRNA). RNA functions. Central dogma in biology.

**LESSON 60 – 2 hours. Supramolecular complexes. Viruses.**

Cellular and non-cellular supramolecular complexes. Structure of viruses: capsid, capsomers, DNA (RNA) core. Reproduction of viruses. Virion – definition. Bacteriophages (phages). Structure of phages: head, tail, tail fibers. Reproduction of phages. Origin of viruses. Viruses – agents of diseases. Spreading of viral infections. AIDS. HIV. Viroids. Prions.

**LESSON 61 – 3 hours. Cell – the basic unit of the living matter**

Cell – the smallest biological system. Cell theory. The main postulates of the cell theory. The cell as a level of organization of the living matter. Devices for microscopic observation

**LESSON 62 – 2 hours. Prokaryotic cell**

Prokaryotic cells. Eubacteria. Structure: cell membrane, cell wall, nucleoid (bacterial chromosome), pili, flagella, spores. Types: cocci, bacilli, spirilla. Nutrition of bacteria: heterotrophs (parasites and saprophytes) and autotrophs. Respiration of bacteria: aerobes and anaerobes. Spore formation. Cyanobacteria. Importance of bacteria. Infectious diseases



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**LESSON 63 – 2 hours. Eukaryotic cell**

Eukaryotic cell. Shape and size of cells. Inner structure of the cells: cell membrane, cytoplasm, nucleus. Cell organelles. Common (universal) organelles: membrane-bound and non-membrane-bound organelles. Importance of the membranes in the eukaryotic cells. Specialized organelles.

**LESSON 64 – 3 hours. Cell membrane**

Plasmalemma. Structure of the cell membrane: fluid-mosaic model. Transport of substances across the cell surface membrane: passive and active. Osmotic pressure. Diffusion. Cytoses: endocytosis (phagocytosis and pinocytosis), exocytosis. Specialized structures of the cell membrane: cilia, flagella, microvilli

**LESSON 65 – 2 hours. Non-membrane bound and single-membrane bound organelles**

Non-membrane bound organelles. Ribosomes. Structure of ribosomes: small and large subunits. Cytoskeleton: microfilaments, intermediate filaments, microtubules. Cell centre, centrioles. Single-membrane organelles. Endoplasmic reticulum: rough and smooth.

Golgi complex – structure and function. Lysosomes – structure and function. Peroxisomes. Secretory vesicles. Vacuoles in animal and plant cells. Interaction between single-membrane organelles

**LESSON 66 – 2 hours. Double-membrane bound organelles**



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Mitochondria. Structure of mitochondria: outer and inner membrane, cristae, matrix.  
Chloroplasts. Structure of chloroplasts: outer and inner membrane, thylakoid, stroma, granum.  
Chlorophyll. Origin of double-membrane organelles. Main energy source in eukaryotic cells.  
Adenosine triphosphate (ATP)

**LESSON 67 – 3 hours. Nucleus**

Nucleus. Structure of the cell nucleus: nuclear envelope, pores, nuclear sap. Chromatin.  
Nucleoli. Main functions of the nucleus. Chromosome structure before (incompact) and during  
(compact) cell division. Chromosome types: metacentric, submetacentric and acrocentric.  
Chromosome set – karyotype. Levels of organization of chromatin: DNA double helix, beads on a  
string, chromatin fiber, scaffold associated chromatin loops, chromatid. Euchromatin and  
heterochromatin. Sex chromatin

**LESSON 68 – 2 hours. Exercises and Preparation for a Test**

Chemical composition of the cell. Viruses, prokaryotic and eukaryotic cell. Cell organelles

**LESSON 69 – 2 hours. Test № 6**

Chemical composition of the cell. Viruses, prokaryotic and eukaryotic cell. Cell organelles

**LESSON 70 – 3 hours. Genetic processes. Doubling of genetic information.  
Replication**



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Characteristics of replication. Basic enzyme – DNA polymerase. Protein complex of replication – other enzymes: helicase, primase, topoisomerase. Primers and short DNA segments (Okazaki fragments). Stages of replication: initiation, elongation, termination.

**LESSON 71 – 2 hours. Realization of the genetic information. Transcription and translation. Cell structure and cellular processes**

Characteristics of transcription. Basic enzyme – RNA polymerase. Transcriptional factors. Stages of transcription: initiation, elongation, termination. Post synthetic changes of RNA (maturation): precursor molecules, cap and tail, introns, exons, splicing. Characteristics of translation. Basic enzymes – aminoacyl tRNA synthetase, peptidyl transferase. Codons and anticodons. Translational factors. Stages of translation: initiation, elongation, termination.

**LESSON 72 – 2 hours. Cell division. Amitosis and mitosis**

Cell division. Amitosis - definition. Mitosis - definition. Mitotic stages: prophase, metaphase, anaphase, telophase. Mitotic spindle. Cytokinesis. Biological significance of mitosis. Regulation of mitosis.

**LESSON 73 – 3 hours. Cell division. Meiosis**

Meiosis - definition. Meiotic stages: prophase I, metaphase I, anaphase I, telophase I, short interphase, prophase II, metaphase II, anaphase II, telophase II. Crossing over. Biological significance of meiosis.

**LESSON 74 – 2 hours. Cell cycle and cell differentiation. Cell reproduction**



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Cell cycle. Interphase and mitotic cycle. Cell differentiation. Biological significance of cell differentiation. Aging and death of cells.

**LESSON 75 – 2 hours. Application of the cell knowledge in science and practice**

Cell lines: culturing normal and transformed cells. Cell engineering. In vitro fertilization and cultivation in humans. Prenatal screening and diagnostics. Gene therapy

**LESSON 76 – 3 hours. Exercises and Preparation for a Test**

Replication, transcription, translation, mitosis, meiosis, cell cycle

**LESSON 77 – 2 hours. Test № 7**

Replication, transcription, translation, mitosis, meiosis, cell cycle

**LESSON 78 – 2 hours. Exercises and Preparation for the Entrance Exam**

Exercises on test 1, test 2 and test 3

**LESSON 79 – 3 hours. Exercises and Preparation for the Entrance Exam**

Exercises on test 4, test 5, test 6 and test 7

**LESSON 80 – 2 hours. Exercises and Preparation for the Entrance Exam**

Exercises on test 8, test 9 and test 10



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**LESSON 81 – 3 hours. Exercises and Preparation for the Final Exam**

Anatomy, physiology, molecular and cell biology

**Recommended literature**

1. V. Ovcharov, Dimitrov O., Yotovska K., Hristova M., Dimitrova T. 2018, Biology and Health Education, 9. Grade, Student's book, Part 1
2. V. Ovcharov, Dimitrov O., Yotovska K., Hristova M., Dimitrova T. 2018, Biology and Health Education, 9. Grade, Student's book, Part 2

**Syllabus**

1. The Cell
2. Tissues. Epithelial and connective tissue
3. Tissues. Muscular and nervous tissue
4. The organism as an integral unit
5. Digestive system. Nutrition





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6. Digestive system. Digestion in the mouth
7. Digestive system. Digestion in the stomach and intestines
8. Hygiene of nutrition. Health related knowledge about the digestive system
9. Respiratory system
10. Respiratory system. Respiration
11. Hygiene and health related knowledge about the respiratory system
12. Urinary system. Excretion
13. Hygiene and health related knowledge about the urinary system
14. Cardiovascular system. Heart and blood vessels
15. Cardiovascular system. Blood
16. Cardiovascular system. Heart activity. Blood circulation
17. Immunity
18. Hygiene and health related knowledge about the cardiovascular system
19. Locomotive system. Structure of bones and joints. Skull
20. Locomotive system. Vertebral column, chest and limbs
21. Locomotive system. Muscles
22. Reproductive system. Male reproductive system
23. Reproductive system. Female reproductive system
24. Fertilization. Embryonic and postnatal development
25. Nervous system. Spinal cord



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26. Nervous system. Brain
27. Nervous system. Cerebrum
28. Nervous system. Autonomic nervous system
29. Endocrine system. Pituitary gland, epiphysis, thyroid gland, parathyroid glands
30. Endocrine system. Pancreas, adrenal glands, sex glands
31. Sensory systems. Visual sensory system
32. Sensory systems. Auditory, balance, taste, olfactory sensory systems, system of common sensitivity
33. Skin
34. Chemical composition of the cell
35. Carbohydrates and lipids
36. Proteins
37. Enzymes
38. Nucleic acids
39. Supramolecular complexes. Viruses.
40. Cell – the basic unit of the living matter
41. Prokaryotic cell
42. Eukaryotic cell
43. Cell membrane
44. Non-membrane bound and single-membrane bound organelles
45. Double-membrane bound organelles



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- 46. Nucleus
- 47. Genetic processes. Replication
- 48. Realization of the genetic information. Transcription and translation
- 49. Cell division. Amitosis and mitosis
- 50. Cell division. Meiosis
- 51. Cell cycle and cell differentiation
- 52. Application of the cell knowledge in science and practice



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**Test – sample**

**Biology, Test 5, Variant 2**

**Name:** .....

**Group:** .....

I. Encircle the correct answer:

max. 8 points

1. Rhythmical heart contracts and relaxes  
are caused by:

- a) nerves coming from the brain
- b) central nervous system
- c) special cardiac muscle cells
- d) nerves coming from the spinal cord

5. The cardiac muscles are supplied with  
blood through:

- a) aorta
- b) pulmonary veins
- c) coronary arteries
- d) pulmonary arteries

2. Which of the following is NOT correct:

- a) after lymph nodes the lymph is rich of erythrocytes
- b) the lymph vessels flow into blood vessels
- c) before the lymph nodes the lymph is like the tissue fluid
- d) a part of the tissue fluid enters the lymph capillaries

6. Pulmonary circulation starts with

- a) left ventricle and aorta
- b) left atrium and pulmonary vein
- c) right ventricle and pulmonary artery
- d) right atrium and vena cava



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3. During the ventricle contraction:
- a) atrioventricular valves are open
  - b) semi-lunar valves are closed
  - c) atrioventricular valves are closed
  - d) atrioventricular and semi-lunar valves are open
4. Which of the following doesn't lead to hypotension:
- a) atherosclerosis
  - b) lack of enough liquids in the body
  - c) improper diet and bad nutrition
  - d) genetic factors
7. After interaction between Ag and Ab the result is:
- a) clot
  - b) coagulation
  - c) agglutination
  - d) thrombus
8. During the atrium contraction:
- a) atrioventricular valves are open
  - b) semi-lunar valves are open
  - c) atrioventricular and semi-lunar valves are closed
  - d) atrioventricular and semi-lunar valves are open

**II. Give brief answers for the following features of the heart: max. 11 points**

- it has a size of a .....
- three layers of the heart ....., ....., .....
- wall
- protective sac .....
- valves between atria and ventricles ....., .....
- a blood vessel going out of the right .....
- ventricle



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- a blood vessel entering the left atrium .....

III. Write 3 types of internal extracellular body fluids (liquids): max. 3 points

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IV. Write 3 types of blood vessels: max. 3 points

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V. Write 5 diseases of cardiovascular system: max. 5 points

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VI. Describe the blood groups B, AB and Rh-: max. 12 points

.....  
.....  
.....  
.....  
.....  
.....

VII. Read the text carefully and fill in the gaps: max. 10 points

..... (platelets) are produced in the ..... They play an important role in ..... This process is carried out when a blood vessel is .....



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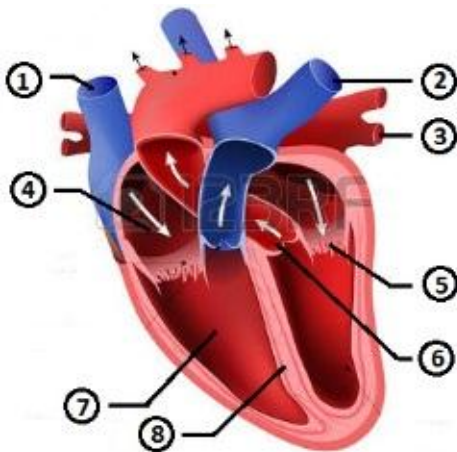
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Then the platelets release a chemical. Due to this chemical, the soluble plasma protein called ..... turns into insoluble stringy protein ..... The stringy protein threads and erythrocytes form a ..... to cover the wound. .... (white blood cells) protect wounded area from infection. Unlike the erythrocytes they have a distinct ..... and can ..... like amoebae.

VIII. Write the parts of the heart shown on the drawing:

max. 8 points



1. ....
2. ....
3. ....
4. ....
5. ....
6. ....
7. ....
8. ....