Assessment tools for certification
in the discipline "Biochemistry, biochemistry of the oral cavity"
for students of the educational program
specialist in the specialty 31.05.03 Dentistry,
direction (profile) Dentistry,
form of study full-time
for the 2023-2024 academic year

№	**exam questions**
1.	Enzymes. Features of enzymatic catalysis. Enzyme specificity. Classification and the nomenclature of enzymes.
2.	Primary structure of proteins. Properties of peptide bonds. Relationships between primary structure and protein biological properties (on the example of hemoglobin and insulin).
3.	The factors determining conformation changes of proteins. Denaturation, factors its causing. Protection from denaturation by the specialized heat shock proteins (chaperons).
4.	The active site of proteins and its specific interaction with ligand as a basis of biological function of proteins. The protein-ligand complementary interaction.
5.	The nutrition. The basic food substances – proteins, carbohydrates, fats, daily allowed (requirement). Essential components of the basic food substances. Mineral components of food.
6.	Physico- chemical properties of proteins . Molecular mass, the sizes and the form, solubility, ionization and hydratation, charge.
7.	Lipid composition of membranes - phospholipids, glycolipids, cholesterol. Proteins of membranes - integral, peripheral, “anchored”. A role of different components of membranes in formation of structure and functions
8.	Classification of proteins according to their solubility, chemical nature and biological function. Examples of representatives of certain classes.
9.	Dietary lipids, their digestion. Absorption of the digested products. Resynthesis of triacylglycerols in a wall of intestines. Chylomicrons formation and transport of dietary lipids. The role of the lipoproteinlipase.
10.	The basic carbohydrates of animals, a biological role. Carbohydrates of food, digestion of carbohydrates.
11.	The structure of enzymes. Active and allosteric sites. Interaction of enzymes with ligands, "key –and- lock" model and “Induced fit” model for substrate binding.
12.	Inhibition of enzyme activity: reversible and irreversible; competitive. Drugs acting as inhibitors.of enzyme activity.
13.	Regulation of enzyme. Allosteric inhibitors and activators, cooperative changes quaternary structures of allosteric enzymes.
14.	. Regulation of enzyme activity by covalent modification (phosphorylation

	and dephosphorylation). Hormonal regulation of enzyme action.
15.	Blood lipoproteins, classification, features of a structure. A role of each type of lipoproteins in transport of various kinds of lipids. Lecithin-cholesterol-acyltranferase, a biological role. Clinical significance of blood lipoproteins determination.
16.	The major lipids of human tissues. Fats. Fatty acids of human tissues, structure features. Essential fatty acids. The essential components of dietary lipids for the human organism.
17.	Importance of proteins in the human nutrition. Physiological protein minimum. Pool of amino acids in cells. Essential and nonessential amino acids. ·Nitrogen balance and it's biomedical importance.
18.	The structure of nucleic acids. The bonds forming primary structure of nucleic acids. Features of DNA and RNA structure. Secondary structure of DNA and RNA, the bonds its stabilizing. Denaturation and renativation DNA. Hybridization DNA- DNA and DNA - RNA . Tertiary structure of DNA. Histones, the characteristic, participation in formation of tertiary structure DNA.
19.	Types of RNA, features of secondary and tertiary structure, functions of RNA. A structure of ribosomes in pro and eukaryotic cells.
20.	Insulin, biosynthesis. A role of insulin and contrainsular hormones (adrenaline and glucagon) in regulation of a metabolism. Change of the hormonal status and metabolic abnormalities under a diabetes. Diabetic coma.
21.	Endergonic and exergonic reactions in an alive cell. High energy phosphate compounds. Dehydrogenation of the substrate and oxidation of hydrogen as the basic energy source for synthesis ATP.
22.	The concept of a gene in molecular biology. A biological code: the basic properties and characteristics. Features of structure tRNA, allowing it to execute a role of the adapter. Biosynthesis aminoacyl-tRNA. Aminoacyl-tRNA -synthetase, its specificity.
23.	Protein digestion. The major enzymes for gastrointestinal protein and peptide degradation. Structure, properties, specificity and activation mechanisms of these enzymes.
24.	Biological membranes, a structure and composition, functions and the general properties: fluidity, cross asymmetry, selective permeability.
25.	Secondary and tertiary protein structures. Types of interactions between amino acid side chains in stabilizing the secondary and tertiary structures. Domain structure and its role in functioning proteins. Importance of chaperons (heat shock proteins) in Protein folding.
26.	Factors affecting enzymatic reaction velocity. Effect of temperature, pH, concentration of enzyme and substrate on reaction velocity. Units of enzymatic activity measurements.
27.	Blood glucose level as homeostatic parameter. A role of insulin, glucagon, adrenaline in the regulation of glucose level. A role of adenylate cyclase

	signal transduction system in this process.
28.	Hormones of a thyroid gland. Synthesis of thyroxine, its influence on a metabolism. Metabolic abnormalities under hypo- and hyperthyroidism. Endemic goiter.
29.	Chemical structure and metabolic effects of hypothalamic and pituitary hormones. Feedback regulation of hormone synthesis.
30.	Regulation of water and electrolyte homeostasis. Molecular structure, sources and effects of aldosterone and vasopressin. Renin-angiotensin regulatory system. Role of aldosterone in saliva formation.
31.	Trycarboxylic acid cycle: a sequence of reactions and the characteristic of enzymes. A role of a cycle in a metabolism.
32.	Biosynthesis of glucose from amino acids (gluconeogenesis), glycerol and lactate; regulation of the gluconeogenesis. Interrelation of the glycolysis in muscles and gluconeogenesis in a liver (Cori cycle).
33.	Utilization of ammonia in the urea cycle - reactions, compartmentalization of the urea cycle enzymes, regulation, amount of urea excreted per day in the urine.
34.	Catabolism of heme. Bilirubin detoxication, "direct" and "indirect" bilirubin. Jaundices: hepatocellular, hemolytic and obstructive.
35.	Storage and mobilization of fats in an adipose tissue, a physiological role of the processes. Importance of insulin, adrenaline and glucagon in regulation of the lipid metabolism.
36.	Degradation of fatty acids in a cell. Activation and transport of fatty acids into mitochondria. ß-oxidation of fatty acids, energy yields.
37.	Transcription. Definition. Principles of transcription (complementarity, antiparallelity, unipolarity, asymmetricity). Stages of transcription. Structure of RNA polymerase: role of subunits ($\alpha 2\ \beta\beta'\sigma$). Initiation of this process. Elongation and termination of transcription.
38.	The structural organization of the respiratory chain. NADH dehydrogenase. Cytochrome C reductase. Cytochrome C oxidase. Features of structure, functions. Coenzyme components of the mitochondrial electron transport chain.
39.	Assembly polypeptide chain on a ribosome. The characteristic of stages initiation, elongation and termination. Peptidyltransferase activity of rRNA.
40.	Hormone target cells. Signal transduction via membrane and intracellular receptors. Types of membrane receptors. Structure and function of G proteins.
41.	Degradation of nucleic acids. Endo- and exonucleases. Purine nucleotide catabolism. Disturbances and misregulation of purine nucleotide metabolism. Genesis, detection and treatment of gout.
42.	Scheme of the purine nucleotide biosynthesis. Inosine monophosphate (IMP) is common precursor of adenosine monophosphate (AMP) and guanosine monophosphate (GMP).

43.	Amino acid oxidative deamination and metabolic role of one. The types of amino acid oxidative deamination.
44.	Amino acid transamination. Aminotrasferases and their structure and properties. Role of vitamin B_6 in amino acid transamination. Biological implication of amino acid transamination. Clinical significance of serum aminotransferases activity determination
45.	Catabolism of the basic food substances in a cell - carbohydrates, fats, amino acids. Concept about specific and common pathways of catabolism.
46.	The oxidative decarboxylation of the pyruvic acid: the characteristic of the process. The pyruvate dehydrogenase complex.
47.	Aerobic oxidation of glucose in a cell. A sequence of reactions up to formation of the pyruvate (aerobic glycolysis). Physiological role of the aerobic oxidation.
48.	Glycogen, the biological importance. Biosynthesis and mobilization of glycogen. Regulation of the formation and degradation of glycogen.
49.	Metabolism of phenylalanine and tyrosine. Diseases eventuated from hereditary breakdowns of phenylalanine/tyrosine metabolism. Detection, evaluation and treatment of phenylketonuria, alcaptonuria and albinism.
50.	Biosynthesis of fatty acids. The basic stages of process. Regulation of the fattty acids metabolism.
51.	Biosynthesis of DNA (replication). Substrates, energy sources, a template, enzymes and proteins factors of replication. Stages of replication.
52.	Biosynthesis and utilization of the ketone bodies. Ketone bodies as energy source. The course of ketosis at starvation and a diabetes.
53.	Heme biosynthesis and its regulation. Infringements of synthesis heme (porfirias). An iron metabolism: absorption, transport, storage.
54.	Anaerobic oxidation of glucose. Reactions of the glycolytic oxidoreduction; the substrate level phosphorylation. physiological role of the anaerobic oxidation of glucose.
55.	Trycarboxylic acid cycle, summary of the process. Integration of a cycle with the electron transport chain. Regulation of the trycarboxylic acid cycle.
56.	Trycarboxylic acid cycle. Anabolic and anaplerotic functions of the trycarboxylic acid cycle.
57.	Transmembrane electrochemical potential as the intermediate form of energy at oxidative phosphorylation. H +-ATP-synthetase: biological role, localization, structure, mechanism of ATP synthesis. Mitchell's theory.
58.	Proteins of bone tissue. Features, composition and structure of bone collagen type I. Osteonectin, osteocalcin, ostepontin and sialoprotein as mineralization regulators.
59.	Enzymes of bone tissue. The role of alkaline phosphatase and pyrophosphatase in the mineralization of bone tissue. Stages of mineralization of bone and tooth tissues. Factors influencing on the

	processes of mineralization.
60.	Functions of saliva. Physico-chemical properties, the daily amount of saliva. Mechanism and regulation of saliva formation.
61.	Organic composition of saliva. Proteins of saliva: mucins, proteins rich in proline, statcherins, histatin, cystatin, cationic and anionic glycoproteins; their chemical composition and functions.
62.	Mineral composition of saliva. Macro and microelements of saliva. The structure of calcium phosphate micelle. The role of oral fluid in the mineralization of tooth enamel.
63.	Stages of bone tissue remodeling. Regulation of bone tissue remodeling and development.
64.	The reasons and manifestations of a rickets, hypo- and hyperparathyroidism.
65.	The structural organization intercellular matrix. Adhesive proteins intercellular matrix: structure and functions fibronectin and laminin.
66.	Structure and functions of glycosaminoglycans (hyaluronic acid, chondroitin sulfate, heparan sulfate). Structure of proteoglycans.
67.	Posttranslational processing (maturing) of initial polypeptide chains (partial cleavage, connection of nonprotein components, modification of amino acids) on an example of maturing of collagen
68.	Polymorphism of collagen: fibreformation, associated with fibres, microfibred, "anchored" types of collagen, component of basal membrane.
69.	Immunoglobulins, classes of immunoglobulins, features of a structure and functioning. Variety antigen - linkage sites H-and L-chains of immunoglobulins. Salivary immunoglobulin A.
70.	Structure and metabolism of tooth tissues. The structure of enamel. Formation of organic base of enamel.
71.	Structure, composition and metabolism of tooth tissues: Dentine, Cement, Pulp.
72.	Micro elements. The value for the life of the body, the biological significance for tooth tissues. The main sources for the body. Regional pathologies associated with lack of trace elements.
73.	Protective and cleansing function of saliva. The role of immunoglobulins in saliva, lysozyme and mucin in protecting the oral cavity from bacterial infections. Structure and synthesis of lysozyme and mucin.
74.	Collagen: Features of amino acids composition and sequence, primary and secondary structure. Interrelation of collagen structure and function. A role of an ascorbic acid in maturing collagen
75.	Features of biosynthesis and maturing of collagen. A role of an ascorbic acid in maturing collagen.
76.	Mineral substances of the human body. Macro elements, their role. Mineral components of food.
77.	Mineralized tissues. The chemical composition of various tissues, the ratio of mineral and organic substances. Crystals of hydroxyapatite and

	fluorapatite, forming mineralized tissues. Stages of isomorphic substitution of elements of the crystal lattice and its role in the formation of apatite crystals.
78.	Chemical structure and metabolic effects of parathyroid hormone.
79.	Macro element Ca The value for the life of the body, the biological significance for tooth tissues. The main sources for the body. Mechanisms of hormonal signal transduction by calcium via phosphatidylinositol pathway.
80.	Macro elements. P The value for the life of the body, the biological significance for tooth tissues. The main sources for the body
81.	Vitamins, a biological role. Classification of vitamins, examples. Hyper-, hypo-, and avitaminosises, the reasons of occurrence. Vitamin C.
82.	Coenzyme functions of vitamins (on an example of transaminases and dehydrogenases, vitamins B_6, PP). The role of vitamins PP, B6 and the enzyme lysyl oxidase in the formation of collagen fibrils.
83.	Composition and function of connective tissues.
84.	The scheme of cholesterol biosynthesis. Mevalonic acid formation is key reaction in the cholesterol metabolism. β-Hydroxy-β-methylglutaric acid-CoA reductase and regulation of its biosynthesis and activity. Role of cholesterol in cholic acids biosynthesis. Excretion of cholesterol and cholic acids.
85.	Regulation of absorption, storage and release of calcium ions
86.	Mechanism and biological role of amino acid decarboxylation. Structure and function of biogenic amines such as histamine, serotonin, GABA. Inactivation of biogenic amines via deamination, or methylation
87.	Chemical structure and metabolic effects of calcitonin and calcitriol.
88.	Enzymes. Features of enzymatic catalysis. Enzyme specificity. Classification and the nomenclature of enzymes.

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Considered at the meeting of the department of "10" _may_ 2023, protocol No 16

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