Biochemistrytest keypoints

 **Test I**

1. Structure and characteristics of amino acids included in proteins. Classification of amino acids
according to the structure and properties of their side chains (e.g. polar, nonpolar, aliphatic,
aromatic, containing specific functional groups, neutral, acidic, basic). Amphoteric properties of
amino acids, zwitterions. Structure of some amino acid derivatives (such as selenocysteine, 4-
hydroxyproline, 5-hydroxylysine). Structure of some non-protein amino acids of physiological
importance (homocysteine, homoserine, ornithine, citrulline, β-alanine, γ-aminobutyric acid, β-
aminoisobutyric acid). Structure and peptide binding properties. Structure and function of
biologically important peptides (glutathione, peptide hormones, peptide antibiotics). Biosynthesis
and insulin structure.
2. Proteins - classification, characteristics of the I, II, III and IV structure, properties and functions.
Detailed construction of α-helix and β-sheet. Amino acids that stabilize, destabilize and "break" α-
helix. Types of bonds involved in the formation of the correct protein conformation (hydrogen,
ion, electrostatic, hydrophobic, van der Waals bonds). Post-translational modification of proteins.
Structure of ribonuclease. Construction and synthesis of collagen. Prions as an example of the
medical significance of proper folding of the polypeptide chain.
3. Correlation between protein structure and its function - myoglobin, hemoglobin and
immunoglobulins. The physiological role of hemoglobin and myoglobin. The mechanism of
combining oxygen with myoglobin and hemoglobin. Changes in the structure of hemoglobin
occurring at various stages of human development. Glycosylated hemoglobin.
Hemoglobinopathies.
4. Functions performed by blood. Organic and inorganic components of plasma. Characteristics and
functions of plasma proteins. Structure and functions of erythrocytes. Buffering properties of
blood - carbonate buffer and the role of hemoglobin in buffering (Bohr and Halden effect). The
physiological role of hemoglobin and myoglobin in the transport and storage of oxygen, the
oxygen dissociation curve, respectively. The mechanism of combining oxygen with myoglobin and
hemoglobin (the role of distal and proximal histidine, cooperativity). Influence of temperature,
pH, CO2 and 2,3-BPG on the oxygen dissociation curve Hb.

**Test II**

1. The enzyme - structure, features, ways to create enzyme-substrate complexes. The specificity of
the enzyme relative to the substrate and the type of catalyzed reaction. The concept of
isoenzyme, coenzyme, cofactor. Physical and chemical properties of isoenzymes. The significance
of isoenzymes in diagnostics. Classification of enzymes.
2. Kinetics and mechanism of enzymatic reaction of Michaelis-Menten and allosteric enzyme
(activators and allosteric inhibitors, examples of allosteric enzymes, concerted and sequential
model of allosteric protein, kinetics of the allosteric enzyme reaction); regulation by feedback and
its examples in the human body; covalent modification of enzymes: phosphorylation and specific,
limited proteolysis (proenzymes, zymogens, autocatalysis). The influence of physical and chemical
factors on enzyme activity (temperature, pH, enzyme, substrate and product concentration).
Kinetics of enzymatic reaction: initial and maximum rate of enzymatic reaction, Michaelis
constant, Michaelis-Menten equation, Lineweaver-Burk plot. Regulation of enzyme activity. Types
of inhibition with examples of inhibitors used in medicine: acetylsalicylic acid, penicillin,
fluorouracil, methotrexate, allopurinol. Units of enzymatic activity.
3. Vitamins soluble in water and fats - structure and importance in metabolic processes. The
structure of coenzymes and functions performed by coenzymes in enzymatic reactions.
4. The role of enzymes in the digestion of carbohydrates, lipids, proteins and nucleic acids.
Composition and role of digestive juices. The role of bile acids in the digestive process. The
mechanism of the synthesis of hydrochloric acid by the parietal cells of the stomach. Diversified
role of hydrochloric acid. Biosynthesis of bile acids and regulation of this process. Hepaticintestinal circulation of bile acids. Molecular mechanisms of absorption of digestive products.