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KEYPOINTS FOR BIOCHEMISTRY ENTRANCE TESTS - I semester 2024/2025

Tutorial 1. QUALITATIVE ANALYSIS OF AMINO ACIDS AND PROTEINS

- Principle of laboratory tests: ninhydrin reaction, xanthoproteic reaction, Adamkiewicz-Hopkins' reaction, Sakaguchi reaction, lead sulfide test, biuret reaction, denaturation of proteins, protein precipitation reactions (salting out), amphoteric properties of proteins.
- Structures, names and characteristics of proteinaceous amino acids.
- Classification of amino acids according to their structure and properties of their side chains.
- Structure, significance and properties of peptide bond.
- Drawing short peptides, including glutathione.
- Examples of physiologically important peptides: glutathione, peptide hormones.

Tutorial 2. QUANTITATIVE ANALYSIS OF PROTEINS

- Principle of laboratory tests: determination of protein concentration using the biuret method and Lowry's method.
- Definition of calibration curve and calibration factor.
- Calculation of the protein concentration in the diluted solutions.
- Proteins - classification, characteristics of I°, II°, III° and IV° structure.
- Characteristics of α-helix and β-sheet.
- Properties of I°, II°, III° and IV° structure of collagen, myoglobin, hemoglobin, prions, immunoglobulins.

Tutorial 3. QUALITATIVE AND QUANTITATIVE ANALYSIS OF BLOOD COMPONENTS

- Principle of laboratory tests: benzidine reaction, quantitative determination of Hb by the cyano-methemoglobin method, detection of iron in hemoglobin, preparation of acid and alkaline hematin, detection of blood lipids.
- The mechanism of oxygen binding by myoglobin and hemoglobin.
- Effect of various factors on oxygen binding by hemoglobin.
- Types and derivatives of hemoglobin.
- Bohr and Halden effect.
- Characteristics and functions of blood plasma proteins.

Tutorial 4. DISORDERS OF PROTEIN STRUCTURE

- Issues described in the scientific articles provided by the teacher.

Tutorial 5. ISOLATION OF PROTEIN FROM BIOLOGICAL MATERIAL

- The principle of isolation and purification of invertase from yeast.
- Isolation and purification of proteins from biologic materials - basic methods.
- Definition of specific activity of an enzymatic preparation.
- Enzyme - structure, features, methods of forming enzyme-substrate complexes.
- Units of enzymatic activity.
- Enzyme classification.

Tutorial 6. ENZYMATIC KINETICS

- Kinetics and mechanisms of enzymatic reaction.
- Determination of K_m and V_{max} from the Michaelis-Menten curve and the Lineweaver-Burke's plot.
- Regulation of enzyme activity.
- Types of inhibition and the effect of competitive and non-competitive inhibitors on K_m and V_{max} values (Michaelis-Menten and Lineweaver-Burke graphs).

Tutorial 7. QUALITATIVE AND QUANTITATIVE ANALYSIS OF SELECTED VITAMINS

- Principle of laboratory tests: detection of vitamins A, D, C, colorimetric determination of vitamin C concentration.
- Structure of water- and lipid-soluble vitamins, the role they play in the human body.
- Hypo- and hypervitaminosis.
- Names and structures of coenzymes and their functions in enzymatic reactions.

Tutorial 8. SELECTED PROPERTIES OF DIGESTIVE JUICES

- Principle of laboratory tests: detection of pancreatic amylase, trypsin, lipase, detection of protein and mucin in saliva, detection of sugar residue in mucins, determination of gastric acidity, detection of bile acids.
- Enzymes involved in the digestion of carbohydrates, lipids, proteins and nucleic acids.
- Composition and role of digestive juices.
- Synthesis and role of hydrochloric acid.
- Definition of gastric acidity: total, free, related.
- The role of bile acids in the digestion process.
- Primary and secondary bile acids.

Tutorial 9. ENZYMES IN MEDICINE

- Issues described in the scientific articles provided by the teacher.