The list of questions to the control test
in sections **"Introduction to biochemistry", "Enzymology and biological oxidation"**
for 2017/18 acad. year

1. Subject and tasks of biochemistry. Objects and methods of biochemical research in clinic and experiment. A brief history of biochemistry. Biochemistry importance for doctor.
2. Characteristics of main biochemical methods (chromatography, electrophoresis, salting out).
3. Protein structure. Levels of structural organization of protein. Characteristics of bonds. Species specificity of proteins. Polymorphism of proteins.
4. Conformational changes in the protein structure as a basis of potein function. Proteins biological functions and classification. Oligomeric proteins. Multienzyme complexes. Protein folding. The role of chaperones and chaperonins in protein folding. Pathology of folding (examples).
5. Methods of qualitative detection and quantitative determination of protein. Methods for protein separation and purification. Protein denaturation and renaturation: the mechanisms and characteristics. Using denaturation in medical and laboratory practice.
6. History of enzymology. Properties of enzymes. The similarity and difference between enzymatic and non-enzymatic catalysis. Evidence of protein nature of the enzyme. Separation and purification of enzymes.
7. The structure of enzymes. Simple and conjugated enzymes. Cofactors, coenzymes. The role of vitamins in enzyme structure. Structure and mechanism of action of FAD, FMN, $NAD(P)^+$, TPP, pyridoxal phosphate, coenzyme Q. The value of enzymes in the life processes.
8. The mechanism of enzyme action. Theory of intermediates. Basic concepts of thermodynamics of enzymatic catalysis (Gibbs energy, activation energy, energy barrier). Stages and mechanism of of substrate and enzyme interaction (E.Fisher hypothesis, D. Koshland and modern concepts).
9. Factors influencing the rate of enzymatic reactions (graphs). The kinetics of enzymatic reactions. Km - determining the physiological significance.
10. The enzyme activity. Regulation of enzyme activity (the role of hormones, cAMP, Ca^{2+}, IP_3). Chemical modification of enzymes (limited proteolysis, phosphorylation-dephosphorylation cycle, etc.). Units of enzyme activity and quantity.
11. Inhibition of the enzymes. Types inhibitors, their mechanism of action, examples.
12. Allosteric enzymes. Features of the structure and functioning, properties and biological role. Allosteric regulation of TCA cycle enzymes activity.
13. Nomenclature and classification of enzymes. Examples.
14. Localization of enzymes in the cell. Marker and organ-specific enzymes (enzymes and examples catalyzed reactions). Ontogenetic change in enzyme activity.
15. Isozymes (examples of enzymes and catalyzed reactions), their biological role and the origin. Using isoenzymes in diagnosis.
16. The basic directions of medical enzymology. Enzymodiagnostics, its objects, goals and objectives. The clinical value of enzyme activity determination in myocardial infarction, liver disease, kidney et al.
17. Enzymopathies. Causes, mechanisms of primary and secondary metabolic blocks examples thereof, the degree of clinical symptoms, diagnosis and treatment principles.
18. Enzyme therapy. Route of administration and indications for use. The concept of liposomes, and viral vectors. The use of enzymes in laboratory practice.
19. Metabolism as a condition of life. The concept of anabolism, catabolism and metabolism. Integration of carbohydrate, lipid and protein metabolism. The history of development of the theory of biological oxidation (BO). Bakh-Engler and Palladin-Wieland hypotheses.
20. Conversion and transfer of energy in cells. Redox reactions, redox potential. Biologic oxidation (BO) essence. BO substrates formation scheme. BO main stages. BO value for the organism.
21. Structure and biological role of ATP. Energy phosphates, high enegry bond nature. ATP-cycle – the ways of ATP formation and utilization.

22. The main ways of oxygen consumption. General characteristics of mitochondria (Mt). The structure and function of mitochondria. Comparative characteristics of the mitochondrial membrane. Localization of mitochondrial enzymes. The concept of tissue respiration.
23. Krebs tricarboxylic acid cycle (TCA). Localization, regulation and biological role of the TCA cycle. The energy balance of TCA cycle.
24. The concept of biological oxidation and tissue respiration. Enzymes, coenzymes of biological oxidation. The structure of vitamins and their role in biological oxidation processes.
25. The concept of tissue respiration. The structure and characteristics of electron transporting chain (ETC) components. Localization, the basic principles of operation and structural organization of Mt ETC complexes. Impairments of ETC functions. Low-energy state: characteristics, causes.
26. Oxidative phosphorylation (OP). OP points, P/O ratio. P. Mitchell chemiosmotic hypothesis. Coupled and uncoupled respiration, the mechanisms of coupling and uncoupling. OP uncouplers.
27. Ion gradients as a universal form of ATP energy deposition, transfer and utilization in biological systems. The concept of a "proton" and "sodium" bioenergetics (H^+-ATPase and Na^+/K^+-ATPase).
28. The main ways of oxygen consumption. Microsomal oxidation. Localization, structure and characteristics of microsomal ETC components. Comparative characteristics of mitochondrial and microsomal ETC. The biological significance of microsomal oxidation.
29. The main ways of oxygen consumption. The concept of the peroxide processes. Electronic structure of oxygen atom. The formation and neutralization of reactive oxygen species (ROS). The role of peroxidation processes in normal and pathological conditions.
30. Enzymatic and non-enzymatic antioxidant defense (AOD). Mechanisms of action and biological role. Anti- and pro-oxidants.

<u>The variants will also include:</u>

- Structure of pentapeptide, its name, and all possible charges by interval method (revise the formulas of 20 amino acids, pKa of amino acids).
- Structure of vitamins: B_1, B_2, B_3, B_6, PP. Structure of NAD^+, $NADH+H^+$, $NADP^+$, $NADPH+H^+$, FAD, $FADH_2$, FMN, $FMNH_2$, coenzyme Q, ATP, ADP, AMP, 3', 5'-cAMP, TPP, pyridoxal phosphate.
- The reactions catalyzed by AST, ALT, CPK, LDH. Isozymes: CPK, LDH.
- ROS formation scheme. The reactions catalyzed by catalase, SOD, glutathione peroxidase, Fenton, and Haber-Weiss reactions.

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