

**QUESTIONS FOR SELF-WORK**  
**SUBJECT "BIOLOGICAL CHEMISTRY"**

1. Proteinogenous amino acids: definition, chemical classification. Write and name certain amino acids.
2. Physico-chemical classification of the proteinogenous amino acids. Give examples. Write and name certain amino acids.
3. Name essential amino acids, explain the term "essential", give examples. Write formulas and name certain amino acids.
4. Name nonessential amino acids, explain the term "nonessential", give examples. Write and name formulas of certain amino acids.
5. Peptide bond, principle of its formation, features. Write and name certain amino acids.
6. Primary structure of protein molecule, its definition, the bond which stabilizes it. Write and name certain amino acids.
7. Secondary structure of protein molecule, definition, types, the bond which stabilizes it. Write and name certain amino acids.
8. Tertiary structure of protein molecule, definition, types, the bonds which stabilize it. Write and name certain amino acids.
9. Quaternary structure of protein molecule, definition, the bonds which stabilize it. Write and name certain amino acids.
10. Physico-chemical properties of proteins: dialysis, salting-out; definition, principle, use in practice. Write and name certain amino acids.
11. Denaturation of proteins and factors that cause it. Properties of denaturated proteins. Write and name certain amino acids.
12. Give definition to proteins. Point the main functions of proteins in the human organism. Write and name certain amino acids.
13. Carbohydrates: definition, occurrence in nature, functions in the organism.
14. Pentoses. Chemical structure and biological significance of ribose and deoxyribose.
15. Hexoses. Write the formulas of linear and cyclic forms of glucose, fructose and galactose. Point biological significance of the named hexoses.
16. Oligosaccharides. Chemical structure and native sources of sucrose, lactose, maltose. Point the linkages that stabilize that structures.
17. Homopolysaccharides. Important substances for humans. Write a fragment of the glycogen structure. What linkages do stabilize a glycogen molecule?
18. Homopolysaccharides starch and cellulose. Their occurrence in nature, biological significance. What's common and different in their structure?
19. Lipids: definition, occurrence in nature, main functions in the organism.
20. Triacylglycerols. Structure, physico-chemical properties, biological significance.
21. Sterols and sterides. Their chemical structure, biological role, representatives. Chemical structure and biological role of cholesterol.
22. Saturated and unsaturated fatty acids. Their native sources, physico-chemical properties. Write the formulas of stearic, palmitic, oleic, linoleic and linolenic acids.
23. Glycerophospholipids: chemical structure, examples, biological functions. Write the formula of lecithin.
24. Sphingolipids: composition, occurrence in nature.
25. Glycolipids. Characteristics of the main groups, their biological role.
26. Conjugated proteins: definition, classification, importance for human organism vital activity (give examples).
27. Chromoproteins: definition, subclasses, examples. Briefly characterize myoglobin and write the structure of heme b.
28. Hemoglobin: biological functions, structure, functional forms, pathological forms.
29. Glycoproteins: chemical characteristics, structure. Their functions, occurrence in nature, some examples.
30. Proteoglycans: composition, functions, main classes, occurrence. Write a fragment (dimer) of the hyaluronic acid structure.

31. Heparin: place in the system of classification, biological functions. Write a fragment of the heparin structure.
32. Lipoproteins: classification, composition. Give a short characteristics to the main fractions of blood lipoproteins. Atherosclerosis.
33. Phosphoproteins: their composition, occurrence, biological role, some examples.
34. Metaloproteins. Their principal functions, occurrence, some representatives in the human organism.
35. Give classification and characterize protein components of nucleoproteins that are included in DNP (deoxyribonucleoprotein) in the cell.
36. What is a nucleoside? Give definition, write the structures of all (4) ribonucleosides.
37. What is a nucleotide? Give definition, write and name any 2 deoxyribonucleotides.
38. Nucleic acids: definition, classification, functions. Write a mononucleotide.
39. Primary structure of the nucleic acids. Differences between DNA and RNA. Write a mononucleotide.
40. The Chargaff rules. What nucleic acid these rules are true for? Write a mononucleotide.
41. Secondary structure of the nucleic acids. What bonds do stabilize such a structure? Write a mononucleotide.
42. Tertiary structure of the nucleic acids. What bonds do stabilize such a structure? Write a mononucleotide formula.
43. RNA: definition, classification, biological functions. Write the structural formula of ATP (Adenosine triphosphate), its biological role.
44. DNA: definition, peculiarities of structure, biological role. Write the formula of cAMP (cyclic Adenosine-3',5'- monophosphate).
45. Enzymes: definition, biological significance, classification.
46. Similarity and difference between enzymes and nonenzymatic catalysts.
47. Nomenclature and classification of enzymes. Features of the main classes, examples.
48. General knowledge about enzymatic catalysis, its stages and description.
49. Chemical nature of enzymes. Enzyme parts: apoenzyme, coenzyme (prosthetic group), choloenzyme. Role of coenzyme in enzymatic catalysis; examples of coenzymes.
50. Specificity of enzyme action and theories that explain such an important feature.
51. Zymogens and isozymes: definition, biological significance, examples.
52. Active site of enzyme. How is it composed? What amino acids are more frequently included in its structure? Allosteric site of enzyme.
53. Multienzyme systems: definition, their organization, examples, biological importance of such ensembles.
54. Kinetics of enzymatic reactions: dependence of reaction rate on concentrations of enzyme and substrate. Show graphically and explain.
55. Kinetics of enzymatic reactions: dependence of reaction rate on temperature and pH of medium. Show graphically and explain.
56. Regulation of enzyme activity. Activators (positive effectors), direction of action, examples.
57. Regulation of enzyme activity. Reversible and irreversible inhibition. Competitive and uncompetitive inhibition, examples.
58. Enzymopathology, enzymodiagnosics, enzymotherapy.
59. Medical application of enzymes, diagnostics of enzymes, therapy by enzymes. Explain such directions in study and application of enzymes. Examples.
60. Vitamins: definition, classification, occurrence, importance for humans, causes of hypo- and avitaminoses.
61. Vitamin A: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
62. Vitamin D: nomenclature, sources, chemical structure, biological role, hypo- and hypervitaminosis, pharmpreparations.
63. Vitamin E: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
64. Vitamin K: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
65. Vitamin B<sub>1</sub>: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.

66. Vitamin B<sub>2</sub>: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
67. Vitamin B<sub>3</sub>: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
68. Vitamin B<sub>5</sub>: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
69. Vitamin B<sub>6</sub>: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
70. Vitamin B<sub>c</sub> (B<sub>9</sub>, Folic acid): nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
71. Vitamin B<sub>12</sub>: nomenclature, sources, chemical nature, biological role, hypovitaminosis, pharmpreparations.
72. Vitamin C: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmpreparations.
73. Biotin: nomenclature, sources, chemical structure, biological role, hypovitaminosis.
74. Water-soluble compounds – vitamin P (Bioflavonoids); biological role, occurrence, chemical nature, mechanism of action.
75. Metabolism: definition, characteristics of two principal directions – catabolism and anabolism. Significance of free energy for metabolic processes.
76. Phases of energy liberation from food substances. Phenomenon of “fuel” universalization in the human organism.
77. High energy compounds: definition, biological role, examples. Write the structural formula of ATP (Adenosine triphosphate).
78. Biological oxidation, its species. Tissue respiration as a special kind of biological oxidation. Write the structural formula of NAD<sup>+</sup> (Nicotinamide adenine dinucleotide).
79. Name the structural complexes of the mitochondrial respiratory chain (4). Write the structural formula of FMN (Flavin mononucleotide).
80. Point cytochromes of the mitochondrial respiratory chain, give short descriptions to them. Write the structural formula of FAD (Flavin adenine dinucleotide).
81. Ubiquinone (coenzyme Q): its chemical structure, reaction of reduction, biological role.
82. Oxidative phosphorylation: definition, mechanism of the ATP biosynthesis according to the Mitchell’s chemi-osmotic theory.
83. Give short descriptions to microsomal and free radical oxidations. Prooxidants and antioxidants: definition, examples.
84. Inhibitors and uncouplers of the tissue respiration and oxidative phosphorylation: definition, examples. Write the structural formula of 2,4-dinitrophenol.
85. The Citric Acid Cycle (Krebs cycle) reactions. Localization and biological significance of the Krebs cycle for the human organism.
86. Xenobiotics: definition, characteristics, possible danger for the human organism.
87. Name the main possible consequences of biochemical transformation of drugs in tissues.
88. Point principal phases in metabolism (biotransformation) of xenobiotics and briefly characterize their essence.
89. Describe the process of microsomal oxidation, name its key participants, and explain importance of such metabolic transformations for the human organism.
90. Name the main reactions of xenobiotic biotransformation phase II; give examples of sulfate conjugation and methylation of drug metabolites.
91. Point the main endocrine glands in the human organism and the hormones they produce.
92. Thyroid gland hormones: chemical nature, biological role, hypo- and hyperfunction of thyroid, pharmpreparations
93. Hormones, regulating Ca/P metabolism: chemical nature, biological role, hypo- and hypersecretion, pharmpreparations.
94. Pancreatic hormones: chemical nature, biological role. Abnormalities in functioning of the pancreas; pharmpreparations.
95. Adrenal medulla hormones: chemical structure, biological role, pharmpreparations.

96. Glucocorticoids: chemical structure, biological role; hypo- and hyperfunction of the adrenal cortex. Use of glucocorticoids in practice. Pharmpreparations.
97. Hormones, regulating metabolism of minerals – mineralocorticoids: chemical structure of aldosterone, biological role, hypo- and hypersecretion, pharmpreparations.
98. Male sex hormones: chemical structure of testosterone, biological role; hyposecretion; pharmpreparations.
99. Female sex hormones: chemical structure of estradiol and progesterone, biological role; hyposecretion; pharmpreparations.
100. Anterior pituitary hormones: chemical nature, biological role; abnormalities in secretion; pharmpreparations.
101. Posterior pituitary hormones: chemical nature, biological role; hyposecretion; pharmpreparations.
102. Hypothalamic hormones: chemical nature, biological role; pharmpreparations.
103. Metabolism: definition, characteristics of two principal directions – catabolism and anabolism. Significance of free energy for metabolic processes.
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112. Inhibitors and uncouplers of the tissue respiration and oxidative phosphorylation: definition, examples. Write the structural formula of 2,4-dinitrophenol.
113. The Citric Acid Cycle (Krebs cycle) reactions. Localization and biological significance of the Krebs cycle for the human organism.
114. Digestion of carbohydrates in the human gastro-intestinal tract. Enzymes. Write the structural formulae of sucrose and lactose.
115. Parietal digestion of carbohydrates. Mechanism of monosaccharide absorption.
116. Glycolysis. Chemical reactions. Energy output. Biological significance.
117. Alcohol fermentation, chemical reactions. Similarity and distinction between alcohol fermentation and glycolysis.
118. Glycogenolysis. Chemical reactions. Energy output. Biological significance of the process.
119. Mechanism and enzyme system of the oxidative decarboxylation of pyruvate.
120. Gluconeogenesis: definition of the process, description in short, occurrence in tissues, biological significance.
121. Regulation of carbohydrate metabolism. Hormones of hypo- and hyperglycemic effects.
122. Diabetes mellitus and other pathologies of carbohydrate metabolism. Hypoglycemic pharmaceutical preparations.
123. Glycogen storage diseases (glycogenoses) and other carbohydrate metabolism abnormalities. Give short characteristics.
124. Lipids: definition, properties, biological functions, classification.
125. Chemical structure of triacylglycerols, their biological role.
126. Steroids: chemical structure of cholesterol, biological role.
127. Phospholipids: chemical structure of lecithin, biological role.
128. Emulsification of fats in the intestine. Bile acids, chemical nature, biological role.
129. Lipid digestion in the human GIT. Enzymes. Resynthesis of lipids in the intestinal wall.
130. Reactions of the conversion of glycerol to pyruvate.

131.  $\beta$ -Oxidation of fatty acids by the example of stearic acid. Role of carnitine. Fate of acetyl-CoA. Energy output.
132.  $\beta$ -Oxidation of fatty acids by the example of palmitic acid. Role of carnitine. Energy output.
133. Ketogenesis. Write the formulae of the ketone bodies; their biological role.
134. Regulation and pathologies of lipid metabolism.
135. Hyperlipidemias and atherosclerosis as the most widespread lipid metabolism abnormalities.
136. Define essential and nonessential amino acids for humans. Give structural examples. Significance of amino acids for protein and other syntheses.
137. Digestion of proteins in the stomach. Enzymes. Role of HCl. Mechanism of the pepsinogen activation.
138. Digestion of proteins in the intestine. Enzymes. Mechanism of activation of the pancreatic proteolytic enzymes. Autocatalysis.
139. Reactions of transamination by the examples of pyruvic acid and aspartic acid, alanine and  $\alpha$ -ketoglutaric acid. Enzymes. Biological role.
140. Deamination of aminoacids. Definition of the process, examples and its biological significance.
141. Decarboxylation of amino acids. Formation of serotonin, histamin and GABA. Their biological role.
142. The urea cycle: chemical reactions, localization, biological role.
143. Hyperammonemia as a dangerous condition for humans; its causes and consequences.
144. Disorders of amino acid metabolism.
145. Degradation of hemoglobin. Formation of the bile pigments. Characteristics of free and conjugated bilirubin.
146. Pathologies of pigment metabolism. Types of jaundice, their characteristics.
147. Digestion of nucleoproteins in the human GIT.
148. Tissue metabolism of the nucleic acids. Degradation of the purine nucleotides, reactions.
149. Hyperuricemia as a pathological condition in the blood. Gout. Use of allopurinol for treatment.
150. The central dogma of molecular biology which refers to the principal ways of the genetic information transfer.
151. Mechanism of DNA replication. Definition, main stages. Characteristics of the enzymes that take part in the replication process.
152. Reparation of a damaged DNA. Enzymes, catalyzing this process.
153. Transcription of DNA: definition, main stages of the process.
154. The genetic code: definition. Properties of the genetic code.
155. Recognition; its definition. The role of t-RNAs. Formation of aminoacyl-t-RNAs. Characteristics of the enzymes – ARSases.
156. Translation: definition, main stages. Scheme of the translation process.
157. Post-translational covalent modifications of polypeptides synthesized.
158. Preparations that enhance the protein biosynthesis process and its inhibitors.
159. Mutations: main types, characteristics. Molecular diseases.
160. Xenobiotics: definition, characteristics, possible danger for the human organism.
161. Name the main possible consequences of biochemical transformation of drugs in tissues.
162. Point principal phases in metabolism (biotransformation) of xenobiotics and briefly characterize their essence.
163. Describe the process of microsomal oxidation, name its key participants, and explain importance of such metabolic transformations for the human organism.
164. Name the main reactions of xenobiotic biotransformation phase II; give examples of sulfate conjugation and methylation of drug metabolites.

Department Chairman, Prof. \_\_\_\_\_

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