

## **QUESTIONS FOR THE EXAMINATION IN «BIOCHEMISTRY» FOR FOREING STUDENTS**

1. Composition of aminoacids which are included in proteins
2. Classification and aminoacids. List of aminoacids.
3. Functions of proteins.
4. Levels of protein organisation (definition, types of bonds which take part in the formation of the protein structure): primary structure, secondary structure ( $\alpha$ -helix,  $\beta$ -structure), tertiary structure
5. The notion of conformational lability of protein
6. Active protein site and allosteric protein sitea
7. Qualitative test on proteins
8. Classification of proteins
  - 1) according to their molecules shape
  - 2) according to their chemical composition
  - 3) according to their functions
9. Physico-chemical properties of protein
10. Methods of protein purification
11. Methods of protein division
12. Changes in protein composition of a orgahism
13. Composition and functions of hemoglobin
14. The concepts of a monomer and of an oligomeric protein
15. Cooperative interaction of proteomers and hemoglobin
16. Regulation of oxygen binding by means of hemoglobin: Bohr effect.
17. Allosteric regulation of protein functions by the example of interaction between hemoglobin and 2,3-biphosphoglycerate.
18. Structure of enzymes:
  - a) Apoenzyme, co-enzyme, co-factor, their role in catalysis
  - b) Active site of enzymes;
  - c) Allosteric site;
  - d) Isoenzymes
19. Similarities and differences between characteristics of enzymes and nonorganic catalysts
20. Characteristics of enzymes:
  - A. Specificity (substrate (absolute, group, stereospecificity) and catalytic specificity)
  - B. Catalytic efficiency
  - C. Lability of enzymes
  - D. Capacity of enzymes to regulation
21. Mechanism of enzymatic activity
22. Classification and nomenclature of enzymes.
23. Kinetics of enzymatic reactions (saturation of an enzyme with a substrate; Michaelis-Menten equation, Michaelis constant)
24. Dependence of enzymatic activity on different factors
25. Activators and inhibitors of enzymes. Types of inhibition

- A) Reversible inhibition
  - 1) Competitive
  - 2) Noncompetitive
- B) Irreversible inhibition
- 26. Regulation of catalytic activity of enzymes
- 27. Enzymopathies
- 28 Application of enzymes in the medicine
  - A. Enzyme diagnostics
  - B. Application of enzymes as medications
- 29. Classification and brief characteristics of vitamins
  - a) Fat-soluble vitamins (A, D, E, K)
  - b) Water-soluble vitamins (B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>, PP, B<sub>c</sub>, B<sub>5</sub>, H, C, P)
- 30. Coenzymatic function of vitamins
- 31. Sources of vitamins
- 32. Avitaminosis
- 33. Definition and structure of nucleic acids:
- 34. Functions of nucleic acids
- 35. Characteristics of primary, secondary, tertiary structures of DNA and RNA
- 36. DNA synthesis (replication)
- 37. RNA synthesis (transcription)
- 38. Reparation
- 39. Protein biosynthesis (translation)
- 40. Inhibitors of matrix biosynthesis
- 41. Protein polymorphism (polymorphism of hemoglobin, blood groups)
- 42. Application of DNA-technologies in the medical sphere
- 43. Composition and functions of membrane
- 44. Composition of membranes in relation to their characteristics
- 45. Participation of membranes in transfer of substances to a cell and back
  - a) simple diffusion
  - b) light diffusion
  - c) active transport
  - d) vesicular transport
- 46. Functioning of K<sup>+</sup>, Na<sup>+</sup>- pump
- 47. Transmembrane signalling
  - 1. adenyl cyclase system
  - 2. inositol phosphate system
  - 3. transmission of a signal by means of intracellular receptors
- 48. Energy exchange (catabolism, anabolism, phases of metabolism related to energy conversion (synthesis and hydrolysis of ATP))
- 49. Mitochondrial electron transfer chain and location of its components
  - a) specialities related to location of enzymes in electron transfer chain
  - b) types of oxyreductases participating in this transfer
- 50. Chemosmotic theory
- 51. Coefficient of phosphorylation, respiratory control, oxidative phosphorylation at the level of substrate, microsomal oxidation

52. Separation of respiration and oxidative phosphorylation
53. Oxidative carboxylation of pyruvic acid (enzymes and coenzymes of pyruvate dehydrogenase complex)
54. Stages of general catabolic pathway and its end-products
55. Basic stages and biological role of citric acid cycle
  - a) order of the reactions within citric acid cycle;
  - b) learn by heart formulas of tri- and dicarboxylic acids;
  - b) names of enzymes taking part in citric acid cycle;
56. Anabolic functions of citric acid cycle
57. Regulation of general catabolic pathway
58. Hypoenergetic conditions
59. Shuttle mechanisms of hydrogen transfer (malate aspartate shuttle and glycerophosphate shuttle)
60. Composition of basic edible carbohydrates: glucose, fructose, galactose, sucrose, lactose, maltose, starch. Location of glycosidic bonds among monosaccharide residues.
61. Order of carbohydrate hydrolysis in digestion tract and enzymes which take place in these processes.
62. Mechanism of transmembrane transfer of glucose to cells
63. Biological significance of production of glucose-6-phosphate which is the key metabolite in monosaccharide metabolism
64. Composition and physical properties of glycogen: monomers, types of glycosidic bonds, solubility
65. Organs of deposition, periods of accumulation and mobilization of glycogen
66. Synthesis of glycogen (glycogenesis)
67. Decomposition of glycogen (glycogenolysis)
68. Characteristics of glycogen mobilization in liver and muscles
69. Regulation of glycogen metabolism
70. Pathologies related to carbohydrate metabolism
71. Glycolysis and glycogenolysis.
72. Order of reactions within glycolysis and enzymes which facilitate them
73. Gluconeogenesis (glucose synthesis)
74. Glucoselactate and glucosealanine cycles
75. Regulation of glycolysis and gluconeogenesis
76. Pentosephosphate pathway of glucose conversion
77. Basic higher fatty acids (formulas of acids, essential acids)
78. Classification of lipids, characteristics and biological functions of lipids
79. Digestion of fats and the role of biliary acids
80. Absorbtion and the mechanism of transport of lipids
81. Basic transportational forms of lipids (chylomicrons, lipoproteins of very low/low/high density): place of their synthesis and functions
82. Reaction which takes place under the influence of lipoproteinlipase: location and activity of lipoproteinlipase
83. Composition, functions, pathways of production and expenditure of cholesterol in the organism

84. Order of reactions of cholesterol biosynthesis, regulation of this process
85. Decomposition of cholesterol and its removal from the organism
86. Composition and pathways of production of primary, secondary and conjugated (paired) biliary acids
87. Enterohepatic cycle of biliary acids and regulation of their synthesis
88. Biochemical basis of cholelithiasis. Hyperlipoproteinemias. Atherosclerosis.
89. Oxidation of fatty acids, bioenergetics of  $\beta$ -oxidation by the example of palmitate
90. Exchange of acetyl-CoA
91. Biosynthesis of fatty acids
92. Regulation of  $\beta$ -oxidation speed and speed of biosynthesis of fatty acids
93. Synthesis of fats in liver and adipose tissue
94. Disturbance of fatty acid. Causes of obesity (alimentary and genetic)
95. Classification of aminoacids:
  - A) 4 groups (non-essential, essential, partly non-essential, conditionally non-essential)
  - B) Glycogenous, ketogenic and mixed aminoacids
96. Nutritional value of proteins and consequences of essential aminoacids deficiency, nitrogen balance
97. Sequence of stages of protein hydrolysis in the digestive tract, specificity of proteolitic enzymes
98. Basic pathways of aminoacid metabolism
  - A) transamination, usage of transaminase in medical diagnostics
  - B) deamination of aminoacids (direct, indirect, oxidative, nonoxidative)
99. Synthesis of non-essential aminoacids
100. Basic sources of ammonia in the organism, mechanism of ammonia toxicity
101. Detoxication of ammonia
102. Biological role of ornithine Krebs-Henseleit cycle, interaction of ornithine cycle and general catabolic pathway
103. Hyperammoniemia. Symptoms, diagnostics, treatment
104. Metabolism of certain aminoacids
105. Decarboxilation of certain aminoacids
106. Synthesis, biological role, ways of deactivation of biogenic amines
107. Role of nucleotides in metabolism
108. Synthesis of ATP and GTP from IMP, participation of aminoacids in these reaction
109. Biosynthesis of pyrimidine nucleotides, regulation of this process, biosynthesis of deoxyribonucleotides
110. Reutilization of nitrogen bases (recovery pathway) and enzymes which catalyze this pathway.
111. Catabolism of purine and pyrimidine nucleotides
112. Disturbance of purine and pyrimidine metabolism. Use of nucleotides synthetic analogues in the medicine
113. Basic systems of metabolism regulation. Hierarchy of organismal regulatory systems

114. Classification of hormones and special characteristics of their biological activity
115. Mechanism of hormonal activity
116. Hormones which regulate energetic metabolism (insulin, glucagon, adrenaline, cortisol)
117. Changes in metabolism in case of diabetes mellitus
118. Composition and pathway of synthesis of hormones of a thyroid gland. Consequences of hypo- and hyperfunction of a thyroid gland
119. Functions and role of water, basic parameters of water-salt homeostasis
120. Composition and mechanism of vasopressin and aldosterone
121. Mechanism of activity of “rennin-angiotensin” system. Pattern of blood volume adjustment in case of blood loss
122. Atrial natriuretic factor
123. Basic functions of calcium and phosphates
124. Composition and mechanism of hormones regulating metabolism of calcium and phosphates: a) parathormone; б) calcitriol; в) calcitonin
125. Consequences of water-salt metabolism disturbance and phosphorous-calcium metabolism
126. Composition and mechanism of sex hormones activity (progesterone, testosterone, estradiol)
127. Hormonal medications and their efficiency
128. Pathways of conversion of carbohydrates in liver
129. Pathways of conversion of fats in liver
130. Pathways of conversion of proteins in liver
131. Deactivation of xenobiotics in the organism.
132. Biotransformation of drugs
133. Ethanol metabolism in liver
134. Induction of protective organismal systems. P-glycoprotein
135. Composition and synthesis of hemoglobin
136. Hemoglobin catabolism
137. Bilirubin metabolism. Types of jaundice. Diagnostics
138. Composition and basic functions of blood
139. Special characteristics of erythrocyte metabolism
140. Proteins of blood plasma
141. Coagulating blood system. Factors of blood coagulation.
142. Anticoagulating blood system
143. Role of vitamin K in blood coagulation
144. Haemorrhagic diseases and thrombotic diseases, their treatment
145. General characteristics of connective tissue. Its functions
146. Composition of glycogen and its metabolism
147. Composition of elastin and its metabolism
148. Glycosaminoglycans and proteoglycans
149. Changes of connective tissue as a result of ageing and wound recovery
150. Hereditary diseases of connective tissue