

Questions for examination

Theoretical part

1. Structural classification of proteinogenic amino acids. Name main classes, give examples.
2. Physico-chemical classification of amino acids, examples.
3. Biological classification of proteinogenic amino acids, examples.
4. Proteins: definition, main functions, examples
5. The protein primary structure. Peptide bond formation.
6. The protein secondary structure: definition, types. Fibrous proteins, examples.
7. The protein tertiary structure. Forces controlling the tertiary structure.
8. The protein quaternary structure. Forces controlling the quaternary structure.
9. Physico-chemical properties of proteins: denaturation, salting-out, dialysis.
10. Carbohydrates: definition. Monosaccharides, oligosaccharides, examples.
11. Polysaccharides. General characteristic of starch, glycogen, cellulose.
12. Lipids: definition, classification, functions.
13. Triacylglycerols: chemical structure and biological role.
14. Sterols and steroids: chemical structure and biological role.
15. Phospholipids: biological functions. Chemical structure of lecithin.
16. Chromoproteins: definition, classes, examples.
17. Structure and function of hemoglobin. Hemoglobin derivatives.
18. Structure and functions of proteoglycans. Main classes of proteoglycans.
19. Glycoproteins; structure and functions.
20. Lipoproteins: classes, their composition, biological role.
21. Metalloproteins. Phosphoproteins. Functions, examples.
22. Nucleic acids: types, cell localization, biological role. Differences between DNA and RNA.
23. The DNA structures. Characterize chromatin proteins.
24. RNA: types, structure and function.
25. Vitamins: definition, classification, occurrence, importance for humans, causes of hypo- and avitaminoses.
26. Vitamin A: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceutical preparations.
27. Vitamin D: nomenclature, sources, chemical structure, biological role, hypo- and hypervitaminosis, pharmaceutical preparations.
28. Vitamin E: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceutical preparations.
29. Vitamin K: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceutical preparations.

30. Vitamin B1: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceuticals.
31. Vitamin B2: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceuticals.
32. Vitamin B3: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceuticals.
33. Vitamin B5: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceuticals.
34. Vitamin B6: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceuticals.
35. Vitamin Bc (B9, Folic acid): nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceuticals.
36. Vitamin B12: nomenclature, sources, chemical nature, biological role, hypovitaminosis, pharmaceuticals.
37. Vitamin C: nomenclature, sources, chemical structure, biological role, hypovitaminosis, pharmaceuticals.
38. Biotin: nomenclature, sources, chemical structure, biological role, hypovitaminosis.
39. Water-soluble compounds – vitamin P (Bioflavonoids); biological role, occurrence, chemical nature, mechanism of action.
40. Enzymes: definition, examples. The enzyme structure. Active site of enzyme. Allosteric site of enzyme.
41. The enzyme classification. Nomenclature of enzymes
42. Mechanism of enzyme action. Specificity of enzymes.
43. Regulation of enzyme activity. Activators (positive effectors), direction of action, examples.
44. Regulation of enzyme activity. Reversible and irreversible inhibition. Competitive and uncompetitive inhibition, examples.
45. Medical application of enzymes, diagnostics of enzymes, therapy by enzymes. Clinical application of alanine aminotransferase, aspartate aminotransferase, lactate dehydrogenase, creatine kinase. Isozymes.
46. Metabolism, anabolism, catabolism. The energy relationships between catabolism and anabolism.
47. The ATP biological role. Characterize substrate level phosphorylation, as a pathway of ATP biosynthesis, give examples.
48. Overview of catabolism. Main stages of catabolism.
49. Mitchell's chemiosmotic theory. Oxidative phosphorylation. Describe ATP-synthase.

50. Microsomal oxidation. Role of cytochrome P450 in detoxification of xenobiotics.
51. Point the main endocrine glands in the human organism and the hormones they produce. Chemical classification of hormones.
52. Thyroid gland hormones: chemical nature, biological role, hypo- and hyperfunction of thyroid, pharmaceuticals
53. Hormones, regulating Ca/P metabolism – parathyroid hormone and calcitonin: chemical nature, biological role, hypo- and hypersecretion, pharmaceuticals.
54. Pancreatic hormones: effects. Abnormalities in functioning of the pancreas; pharmaceuticals.
55. Adrenal medulla hormones: chemical structure, biological role, pharmaceuticals.
56. Glucocorticoids: chemical structure, biological role; hypo- and hyperfunction of the adrenal cortex. Use of glucocorticoids in practice. Pharmaceuticals.
57. Hormones, regulating metabolism of minerals – mineralocorticoids: chemical structure of aldosterone, biological role, hypo- and hypersecretion, pharmaceuticals.
58. Male sex hormones: chemical structure of testosterone, biological role; hyposecretion; pharmaceuticals.
59. Female sex hormones: chemical structure of estradiol and progesterone, biological role; hyposecretion; pharmaceuticals.
60. Anterior pituitary hormones: chemical nature, biological role; abnormalities in secretion; pharmaceuticals.
61. Posterior pituitary hormones: chemical nature, biological role; hyposecretion; pharmaceuticals
62. Digestion of carbohydrates in the gastro-intestinal tract. Enzymes.
63. Mechanism and enzyme system of the oxidative decarboxylation of pyruvate.
64. Gluconeogenesis: definition, biological role. Pentose phosphate pathway: definition, biological role.
65. Lipid digestion in the human GIT. Enzymes. Emulsification of fats in the intestine. Bile acids, biological role. Resynthesis of lipids in the intestinal wall.
66. Digestion of proteins in the human GIT. Enzymes. Mechanism of activation of the pancreatic proteolytic enzymes.
67. Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, maple syrup disease, albinism.
68. Main stages of heme biosynthesis. Disorders of heme biosynthesis (porphyrias).

69. Hyperuricemia as a pathological condition in the blood. Gout. Use of allopurinol for treatment.
70. Mechanism of DNA replication. Definition, main stages. Characteristics of the enzymes that take part in the replication process.
71. Repair of a damaged DNA. Enzymes, catalyzing this process.
72. Transcription of DNA: definition, main stages of the process.
73. The genetic code: definition. Properties of the genetic code.
74. Recognition; its definition. The role of t-RNAs. Formation of aminoacyl-t-RNAs. Characteristics of the enzymes – ARSases.
75. Translation: definition, main stages. Scheme of the translation process.

Practical questions

1. Write chemical formulas of amino acids with Aliphatic R-groups, Hydroxyl R-groups, Sulfur-Containing groups, Aromatic Rings. Chemical formulas of Acidic amino acids and their Amides, Basic amino acids.
2. Write tripeptide from any amino acids, name it.
3. Write chemical formulas of nitrogen-containing bases: Adenine, Guanine, Thymine, Uracil, Cytosine.
4. Chemical formula of nucleotide (from DNA or RNA), name it.
5. Chemical formula of ATP, biological role of ATP.
6. Enzyme kinetics. The influence of enzyme concentration and substrate concentration on velocity of the enzymatic reaction. Make graphs.
7. Enzyme kinetics. The influence of temperature and pH on velocity of the enzymatic reaction. Make graphs.
8. General scheme of Electron transport chain. Name complexes and mobile carriers.
9. Chemical reactions of Krebs cycle. Calculate energy output.
10. Chemical reactions of Glycolysis. Calculate energy output.
11. Chemical reactions of glycerol oxidation to pyruvate.
12. Chemical reactions of β -oxidation of palmitic (stearic) acids.
13. Reactions of transamination by the examples of pyruvic acid and aspartic acid, alanine and α -ketoglutaric acid. Enzymes. Biological role.
14. Decarboxylation of amino acids. Formation of serotonin, histamin and GABA. Their biological role.
15. The urea cycle: chemical reactions, localization, biological role.
16. Degradation of hemoglobin. Formation of the bile pigments. Characteristics of indirect and direct bilirubin.
17. Degradation of the purine nucleotides, chemical reactions of uric acid synthesis.