Questions for the module control work № 1 on the discipline “**Biochemistry”**

**“Biochemical components of a cell”**

1. Sections of biochemistry. Methods of biochemical research: homogenization, filtration, differential centrifugation, chromatography, gel filtration, electrophoresis, isoelectric focusing

2. Bioorganic compounds - the basic classes, functional groups

3. Amino acids - definition, general formula of proteinogenous amino acid chirality, optical activity, Fisher formula for amino acids, L-α-amino acids, classification of amino acids (by radical polarity, the structure of the radical, the number of amino and carboxyl groups, the needs of the body). Properties of amino acids - charge presence, isoelectric point, zwitter ions formation, amphoternist. Qualitative reactions for amino acids

4. Peptides - classification (oligopeptides, polypeptides), polarity, names

5. Peptide bond, its tautomeric forms. Biuret test for peptide bond (with tripeptide, polypeptide).

6. The biological role of proteins. Simple and complex proteins. Classification of complex proteins. Scheme of staggered complete nucleoprotein hydrolysis

7. Polypeptides and proteins, detection of protein in solution (biuret test, precipitation)

8. Physical-chemical properties of proteins and methods of analysis based on them. Factors of protein molecules stability in solution. Types of protein sedimentation and the factors that cause them

9. Levels of protein molecule structural organization and the types of bonds that form and stabilize them

10. Nucleic acid. Monomer units of NA. Types of NA. The main differences between DNA and RNA. Fragments of NA

11. Nitrogenous bases of the purine and pyrimidine rows, their tautomeric forms

12. Nucleosides. Bond between nitrogen bases and pentoses

13. Nucleotides - major and minor. Cyclic nucleotides. Nucleotides in the NA composition, bonds between them

14. Hydrogen bonds between complementary nitrogeneous bases. Double-stranded DNA and pins in the secondary structure of RNA

15. Levels of RNA and DNA structural organization

16. Carbohydrates - definition, classification

17. Classification of simple carbohydrates – by carbon atoms quantity, by the presence of functional groups. United classification

18. Stereoisomerism of monosaccharides. Chiral center of molecule. Amount of stereoisomers. Optical activity

19. The most widespread pentoses and hexoses Fisher, Colli-Tollens, Haworth formulas. Tautomeric forms of MS. Mutarotation. Tollens, Trommer, Fehling reactions for aldoses. Selivanov reaction for fructose. Prove that carbohydrates are polyatomic alcohols by chemical reaction

20. Complex carbohydrates - definition, classification. Classification of disaccharides. DS - formulas, short and full names. Tautomeric forms of DS. Mutarotation. Reactions for reducing DS. Hydrolysis of sucrose. Inversion of sucrose. Invert sugar

21. Homopolisaccharides – classification, monomer units, the main representatives (starch components, glycogen). Iodine-starch reaction

22. Heteropolysaccharides - heparin, chondroitin sulfates, hyaluronic acid

23. Lipids - definition, classification. LChFA - classification, the most important representatives (palmitic, stearic, arahinic, palmitooleinic, oleic, linoleic, linolenic, arachidonic acid). Omega-unsaturated fatty acids

24. Neutral lipids or triglycerides (triacylglycerols) - a general formula, names, examples. Solid and liquid fats. Hydrogenation of liquid fat. Soaps - liquid and solid, obtaining from LChFA and TG. The reactions of esterification and saponification

25. Glycerophospholipids - PhE, PhCh

26. Pro-oxidants, anti-oxidants. Peroxide compounds - formation and destruction in the body. Peroxide number, iodine number, esteric number, saponification number, acidity of oil.

27. Vitamins - definition, classification, main biochemical functions. Qualitative reactions for vitamins

28. Vitamins: В1, В2, В3, В5, В6, В9, В12, C, E, H, coenzymes, which they form. Participation in the biochemical reactions of coenzymes NAD+ and FAD

29. Avitaminosis, hypovitaminosis. Dietary sources of water-soluble and fat-soluble vitamins, daily requirement

30. Fat-soluble vitamins A, D, E, K, F. The biological role of fat-soluble vitamins. Avitaminosis, hypovitaminosis, hypervitaminosis

31. The structure of the water molecule. Hydrogen bond. Hydrogen bonds in the cells of living organisms. Water as a solvent. Ionization of water. pH. Acids and alkalis. Buffer system. Participation of water in the life of living systems

Questions for the module control work № 2 on the discipline

**"Biochemistry"**

**“Enzymes and metabolic pathways. Energy metabolism”**

1. Properties of enzymes common with inorganic catalysts

2. Specific properties of enzymes

3. Units of enzyme activity: U, catal, their ratio, specific activity

4. Classification of enzymes, enzyme code. Enzymes nomenclature

5. Simple and complex enzymes. Holoenzyme, apoenzyme, coenzyme. Cofactors of enzymes, prosthetic groups

6. Oligomeric enzymes. LDH

7. The active center of the enzyme and its sites. Allosteric center

8. The dependence of the enzyme action on pH, temperature, concentration of enzyme and substrate. Effect of substrate saturation

9. Michaelis constant, its significance. Prove what its value is.

10. Michaelis-Menten, Laynuiver-Burk equations, corresponding graphs

11. Enzyme action dependence on activators and inhibitors presence. Competitive and non-competitive inhibition

12. Specificity (relative, absolute, stereo specificity)

13. Theories of enzyme and substrate interaction

14. Regulation of enzymatic processes - allosteric, through covalent modification of enzymes, limited proteolysis, regulatory proteins action

15. Types of metabolic pathways - linear, branched, cyclic

16. Anabolic, catabolic, amphibolic pathways

17. Energy metabolism - exothermic reaction, endothermic reaction

18. Macroergic compounds - NTPh, KrPh, FEP, 1,3-di-Ph glycerate

19. Stages of organic compounds catabolism in the body

20. Reactions of intracellular metabolism - catabolism, biosynthesis, energy exchange

21. CTA enzymatic reactions, coenzymes

22. Dehydrogenase reaction, decarboxylase reactions, reactions that occur with water molecules participation. Limiting reaction of CTA

23. The reaction of substrate phosphorylation

24. Inhibitors of CTA. Malonate block

25. Anapleurotic reactions of CTA

26. CTA - amphibolic process

27. Types of biological oxidation reactions, enzymes

28. Tissue respiration. Respiratory control coefficient. Oligomycyn - an inhibitor of respiration and ATP synthesis

29. Components of mitochondrial RCh, protein-lipid complexes, localization

30. The standard red-ox potentials

31. Inhibitors of electron transport. What parts of RCh do they act in?

32. Inhibition of RCh by malonate

33. Oxidative phosphorylation, coupling points of respiration and phosphorylation

34. Coefficient of oxidative phosphorylation

35. "Free" breathing

36. Chemioosmotyic theory of Mitchell

37. Effect of ionophore valinomicyn

38. Tissue respiration and oxidative phosphorylation uncouplers

Questions for the module control work № 4 on the discipline

**"Biochemistry"**

**“Major Classes of Biomolecules Metabolism”**

1. Common pathways of amino acids metabolism
   1. Proteinogenic amino acids - structure and biological role
   2. Common ways of amino acids converting in the tissues. Anabolic and catabolic pathways
   3. Deamination, its types (reactions, enzymes, coenzymes, products)
   4. Transamination of amino acids (enzymes, coenzymes, intermediates, products, interrelations between transamination and deamination)
   5. Decarboxylation (enzymes, coenzymes, products). The biological significance of biogenic amines
   6. Ways of ammonia formation and excretion. Transport form of ammonia in the body, mechanisms of ammonia detoxication. Ornithine cycle of urea formation.
2. Specific pathways of amino acid metabolism
   1. Points for amino acids oxidation in the citrate cycle
   2. Glucogenic and ketogenic amino acids
   3. Amino acids as precursors of other biomolecules. Glycine metabolism та серину
   4. The exchange of sulfur-containing amino acids. Cysteine and glutathione, biochemical function of glutathione in the organism
   5. The exchange of arginine. Metabolic pathways of phenylalanine and tyrosine
   6. The exchange of triptophan
3. Metabolism of nucleotides
4. Buchanan chart. The sequence of IMP synthesis reactions. AMP and GMP synthesis
5. Synthesis of OMF (orotidyl mono phosphate). UMP synthesis
6. Deoxy NMP synthesis
7. Deoxy TMP synthesis
8. CTP synthesis
9. The difference between the synthesis of purine and pyrimidine nucleotides.
10. Purine catabolism - hypoxanthine, xanthine, uric acid
11. Pyrimidines catabolism
12. Glycolysis. Gluconeogenesis
13. Glycolysis - the value, the total equation
14. Aerobic and anaerobic glycolysis
15. Stages
16. Glycolitic oxidoreduction
17. Regulatory enzymes
18. Irreversible reactions
19. Inversion of glycolysis reactions during gluconeogenesis
20. Compartmentalization of pyruvate to phosphoenolpyruvate conversion
21. Shuttle transport system of oxaloacetate in the cytoplasm
22. Glucose-lactate cycle (Cori), glucose-alanine cycle
23. Aerobic oxidation of glucose
24. Pasteur Effect
25. Stages of glucose complete oxidation
26. Oxidative decarboxylation of pyruvate
27. Energy of one acetyl residue complete oxidation at TAC and respiratory chain
28. Energy of one pyruvate molecule complete oxidation
29. Shuttle transport mechanisms of reduced NAD from the cytoplasm to the mitochondria
30. Energy of one glucose molecule complete oxidation
31. The metabolism of glycogen. Alcoholic fermentation
32. Synthesis of glycogen. Enzymes
33. Glycogenolysis - hormonal regulation
34. Linear areas of glycogen phosphorolysis, hydrolysis branching points
35. Central metabolite of carbohydrate metabolism synthesis
36. Alcoholic fermentation
37. Pentose-phosphate pathway. The metabolism of fructose and galactose
38. Pentose-phosphate pathway stages
39. Reactions of redox stage
40. The chart of the transformations during second stage
41. Pentose-phosphate pathway significance
42. The metabolism of fructose
43. The metabolism of galactose
44. Lipids catabolism
45. Activation of TG lipase
46. Activation of long chain fatty acids
47. Reactions of long chain fatty acids β-oxidation
48. The overall equation of palmitic, stearic acids β-oxidation
49. Transport of acyl residues into the mitochondria (carnitine)
50. Reactions of fatty acids β-oxidation
51. Oxidation of glycerol, energy
52. Ketone bodies - the structure, meaning, synthesis
53. Biosynthesis of lipids
54. Localization of enzyme for long chain fatty acids synthesis
55. Substrate in reactions of long chain fatty acids synthesis
56. Transport of acetyl-CoA from mitochondria in the cytoplasm
57. Synthesis of malonyl-CoA
58. Synthetase of long chain fatty acids – enzymatic complex
59. АCP (acyl-carrier protein)
60. The reactions of long chain fatty acids biosynthesis
61. The overall equation of palmitate synthesis
62. Biosynthesis of triacylglycerols and phospholipids
63. Cholesterol metabolism
64. Synthesis of ketone bodies
65. Mevalonic acid synthesis
66. The diagram of cholesterol synthesis
67. Cholesterol usage by living organisms

Questions for the module control work № 5 on discipline **"Biochemistry"**

**“Biochemical mechanisms of proteins and nucleic acids synthesis. Hormonal regulation of metabolism”**

1. DNA replication, RNA transcription

1) Replication meaning, the mechanism and its justification

2) Topological problems of replication - spiralisation, superspiralisation, chains antiparallelism. Enzymes. SSB-proteins. Θ-structures of prokaryotes. Replication bubbles of eukaryotes, points "ori"

3) Direction of replication, mechanism. Leading and lagging strands. Okazaki fragments

4) Replication enzymes of prokaryotes and eukaryotes

5) Stages of DNA synthesis

6) Transcription - coding and noncoding strands. Promoters characteristic

7) Enzymes of transcription. The stages of transcription

8) Posttranscriptional modification of RNA

* + - 1. Biosynthesis of proteins

1. The genetic code and its properties
2. Stop codons
3. The nuclear chromatin of eukaryotes
4. Ribosomes - prokaryotic, eukaryotic
5. Components of protein synthesis system
6. Eukaryotic polyribosomes (polysomes)
7. Adaptor role of tRNA
8. tRNA interaction with AK
9. Stages and mechanisms of translation
10. Post-translational modification of PP – processing
    * + 1. Hormones as regulators of metabolism and physiological functions
11. Determination and the general characteristics
12. Classification: true and tissue hormones
13. Anatomical classification of true hormone
14. Neurotransmitters and imunomediatory
15. Eicosanoids
16. Peptide growth factors
17. Gastrointestinal hormones
18. Peptides of kinin system
19. Natriuretic peptides
20. Pheromones

4. Biochemical mechanisms of hormonal regulation

1) Hormone-dependent and hormone-sensitive cells

2) Transfer of hormonal signal

3) Ionotropic receptors

4) Metabotropic receptors

5) The secondary messengers

6) The mechanism of steroid and thyroid hormones action

7) The structure of the receptor

8) The structure of the promoter sites that interact with steroid hormone