



The questions for oral part of exam from **Medical Biochemistry** for students of **General Medicine** are divided into three parts and students will choose 3 questions, one from each part.

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I. Energetic metabolism and metabolism of nutrients

1. Respiratory chain – composition, function, inhibition
2. Transport of electrons and H^+ – oxidative phosphorylation, uncouplers
3. Shuttles – transfer of reducing equivalents and Acetyl-CoA
4. Substrate level phosphorylation – macroergic compounds and their importance in metabolism
5. Citric acid cycle – reactions, importance, regulation
6. Amphibolic character of citric acid cycle – anaplerotic and cataplerotic reactions
7. Importance of Acetyl-CoA in intermediary metabolism
8. Importance of pyruvate in intermediary metabolism
9. Importance of glucose-6-phosphate in intermediary metabolism
10. Glycolysis – reactions, importance, regulation and energy balance
11. Gluconeogenesis – reactions, substrates, importance, regulation and energy balance
12. Cori cycle and glucose-alanine cycle – reactions, importance
13. Pentose-phosphate pathway – importance, regulation
14. Biosynthesis and degradation of glycogen – reactions, importance, regulation, energy balance, disorders
15. Metabolism of monosaccharides (fructose, galactose, mannose) – reactions, importance, disorders
16. Biosynthesis of glucuronic acid and its importance in organism
17. Metabolism of complex saccharides – aminosaccharides, GAG, proteoglycans, glycoproteins, importance
18. Oxidation of fatty acids – reactions, importance, energy balance, carnitine shuttle
19. Biosynthesis of fatty acids – reactions, importance, regulation and energy balance
20. Oxidation and biosynthesis of unsaturated fatty acids – reactions, importance
21. Biosynthesis and degradation of triacylglycerols
22. Biosynthesis and degradation of phospholipids, glycolipids and sphingolipids
23. Eicosanoids – importance, enzymes (cyclooxygenase and lipoxygenase)
24. Biosynthesis and utilization of ketone bodies – reactions, importance, regulation
25. Biosynthesis of cholesterol – reactions, importance, regulation
26. Cholesterol as a precursor of biochemically important compounds – bile acids, vitamin D



27. Lipoproteins – classification, structure, function
28. Metabolism of chylomicrons, VLDL and IDL
29. Metabolism of LDL and HDL
30. General mechanisms of amino acid transformation
31. Glucogenic and ketogenic amino acids – their role in intermediary metabolism
32. Formation of ammonia in organism, toxicity and transport of ammonia
33. Urea cycle – reactions, importance, disorders
34. Metabolism of amino acids of pyruvate and oxalacetate groups – synthesis, degradation, function in metabolic processes, disorders
35. Metabolism of sulfur-containing amino acids – synthesis, degradation, function in metabolic processes, disorders
36. Metabolism of amino acids of 2-oxoglutarate and succinyl-CoA groups – synthesis, degradation, function in metabolic processes, disorders
37. Metabolism of aromatic amino acids – degradation, function in metabolic processes, disorders
38. Metabolism of branched-chain amino acids – degradation, function in metabolic processes, disorders
39. Biogenic amines and polyamines – biosynthesis, degradation, function
40. Synthesis and degradation of catecholamines – reactions, enzymes importance
41. Importance of nucleotides (NTP, dNTP) for cell functions and organism – role in regulation processes
42. Degradation of exogenous and endogenous NA, nucleotides and nucleosides, salvage reactions
43. Biosynthesis and degradation of pyrimidine nucleotides – importance, regulation, degradation
44. Biosynthesis and degradation of purine nucleotides – importance, regulation, degradation
45. Biosynthesis and degradation of deoxyribonucleotides and nucleotide based coenzymes

II. General and molecular biochemistry

1. Compartmentalization of biochemical processes on cellular level
2. Structure, composition and properties of cell membranes, membrane transport, importance
3. Formation and toxicity of ROS and RNS – oxidative stress and antioxidant systems
4. Enzymes – general characteristics, structure and function, nomenclature, classification of enzymes
5. Catalysis of biochemical processes – mechanism of action of enzymes, enzyme specificity
6. Kinetics of enzymatic reactions – Michaelis constant (K_m), inhibition of enzymatic reactions
7. Allosteric enzymes – effectors and inhibitors, kinetics, importance in metabolism
8. Isoenzymes and multienzyme complexes – examples, importance
9. Coenzymes of oxidoreductases
10. Coenzymes of transferases



11. Coenzymes of lyases, isomerases and ligases
12. Coenzymes transferring one-carbon groups
13. General regulatory mechanisms of catalytic activity in living systems – expression (constitutive and inducible enzymes), allosteric effects, covalent modification
14. Structure and function of nucleic acids – genetic code and its properties
15. Organization of eukaryotic and mitochondrial genome
16. DNA replication in eukaryotic cells – regulation, inhibition
17. DNA transcription – regulation of gene expression, transcription factors, inhibition
18. Synthesis and posttranscriptional modification of mRNA, tRNA, rRNA and snRNA – synthesis, importance
19. Characteristics of genetic material of prokaryotic cells and viruses (e.g. HIV, SARS-CoV-2)
20. Protein synthesis eukaryotic cells and mitochondria – regulation, inhibition
21. Posttranslational modification of proteins – glycosylation, phosphorylation, acylation,
22. Protein sorting and transport, protein folding, chaperons
23. Degradation of endogenous proteins – ubiquitin, proteasome, lysosome
24. Methods of study and use of NA in diagnostics (e.g. restriction endonucleases, PCR, sequencing, gene therapy)
25. Importance of NA modification – epigenetics, modification of histones, DNA methylation, DNA repair
26. Biochemistry of extra- and intracellular communication – mechanism of signal transduction depending on type of signal molecule
27. Hormone lifespan – from signal for synthesis to inactivation of hydrophilic hormones
28. Hormone lifespan – from signal for synthesis to inactivation of hydrophobic hormones
29. Signal molecules – first and second messenger
30. Hormones acting on membrane receptors – chemical structure, function and regulation, disorders
31. Hormones acting on intracellular receptors – chemical structure, function and regulation, disorders
32. Insulin and glucagon – mechanism of action, importance in regulation
33. Adrenalin, noradrenalin, thyroxin – mechanism of action, importance in regulation
34. Cortisol and aldosterone – mechanism of action, importance in regulation
35. Biochemistry of apoptosis – mechanism, importance

III. Biochemistry of organs and tissues

1. Biosynthesis of heme – importance, regulation, disorders
2. Hemoglobin metabolism – degradation, regulation, derivatives, diagnostic importance
3. Biochemistry of digestion and resorption of saccharides – enzymes, transport, disorders, diagnostics
4. Non-hydrolysable saccharides – prebiotics, effect on resorption of nutrients
5. Biochemistry of digestion and resorption of lipids – enzymes, transport, disorders



6. Biochemistry of digestion and resorption of exogenous proteins – enzymes, transport, disorders
7. Complex relationship between metabolism of saccharides, lipids a proteins
8. Metabolism of water – importance, function, regulation
9. Blood – composition and biochemical function
10. Buffer systems of the organism – function and significance for acid-base balance
11. Proteins of blood plasma – importance, function, diagnostic importance
12. Biochemistry of erythrocytes – energy metabolism, antioxidant protection
13. Biochemistry of coagulation – coagulation cascade, role of thrombocytes, thrombolysis
14. Transport of O₂ and CO₂ – role of hemoglobin, myoglobin, carbonic anhydrase
15. Acid-base balance – role of lungs, kidneys and other organs, disorders
16. Metabolism of Ca, P and Mg – importance, regulation, disorders
17. Metabolism of Na, K and Cl – importance, regulation, disorders
18. Metabolism of Fe, Cu and Zn – importance, regulation, disorders
19. Proper nutrition – energy and nutrition value, biological value of proteins, nitrogen balance, importance of essential nutrients
20. Nutritional disorders – quantitative (malnutrition, obesity) and qualitative (insufficiency of proteins, essential AA and FA, vitamins and minerals), intolerances and food allergies
21. Biochemistry of liver – role of the liver in metabolism of saccharides and lipids
22. Biochemistry of liver – role of the liver in metabolism of nitrogenous compounds
23. Metabolism of xenobiotics – reactions of biotransformation and conjugation phase, excretion
24. Importance of cyt P450 in degradation of xenobiotics – mechanism of action
25. Biochemical markers of liver damage
26. Biochemistry of kidneys – function, specific metabolic pathways
27. Formation of urine, role of the kidneys in blood pressure and acid-base balance regulation
28. Biochemical markers of kidney damage
29. Biochemistry of connective tissue – extracellular matrix, collagen, elastin, GAG
30. Biochemistry of hard tissue – inorganic and organic composition of bones and teeth, mineralization and demineralization, biochemical markers of bone remodeling
31. Biochemistry of skin – keratin, melanin, vitamin D
32. Muscle tissue – composition, function, contraction and relaxation of skeletal, heart and smooth muscles
33. Biochemistry of muscles – energy metabolism, biochemical markers of muscle damage
34. Biochemistry of nervous tissue – specific metabolic pathways, neurotransmitters
35. Biochemistry of CNS – energy metabolism, blood-brain barrier
36. Biochemistry of senses – vision and taste
37. Saliva – composition and biochemical function
38. Urine – composition, diagnostic importance for evaluation of metabolic disorders
39. Biological material and its processing in clinical biochemistry
40. Factors affecting reliability of biochemical results and their interpretation