



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

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## I. General biochemistry and the elements of metabolism

1. Enzymes – general characteristics, structure and function. Naming and classification of enzymes
2. Catalysis of biochemical reactions (e.g. mechanism of enzyme function, specificity of enzymes)
3. Constitutive and inductive enzymes, repression of enzymes, regulation of enzymatic activity
4. Kinetics of enzymatic reactions (Michaelis constant  $K_m$ , inhibition of enzymatic reactions)
5. Allosteric enzymes – effectors and inhibitors, importance in metabolism
6. Coenzymes – classification, structure, function
7. Formation and toxicity of ROS and NOS. Antioxidants (enzymatic – and low molecular antioxidative systems), the role in living systems
8. Respiration chain – composition, function, inhibitors. Electrons and  $H^+$  transport – oxidative phosphorylation, ATP-ase, uncouplers
9. Phosphorylation on substrate level. Macroergic compounds
10. Citric acid cycle – the action, importance, amphibolic character, regulation
11. Anaplerotic reaction of citric acid cycle (biochemical importance)
12. Importance of Acetyl-CoA in intermediary metabolism
13. Metabolic pathways of pyruvic acid – enzymes, importance
14. Conversions of glucose-6-phosphate – its roles in intermediary metabolism
15. Glycolysis – reactions, regulation and energetic balance
16. Gluconeogenesis – reactions, regulation and energetic balance
17. Cori and glucose-alanine cycle – the gist, basic roles
18. Pentose cycle – biochemical importance, regulation
19. Synthesis and degradation of glycogen (enzymes, regulation, disorders) and oligosaccharides (importance, disorders)
20. Metabolism of monosaccharides (e.g. galactose, mannose, fructose) and oligosaccharides – reactions, importance in the organism
21. Metabolism of derivatives of monosaccharides (e.g. glucuronic acid, aminosaccharides) – reactions, importance in the organism
22. Oxidation of fatty acids, energetic balance, carnitine system
23. Biosynthesis of fatty acids, regulation, disorders
24. Biosynthesis and degradation of triacylglycerols
25. Phospholipids (metabolism, regulation, significance)
26. Eicosanoids (classification, function, metabolism, significance)
27. Formation and utilisation of ketone bodies, metabolic causalities and consequences, importance
28. Biosynthesis of cholesterol and its regulation, biological importance, transport of endo/exo-genic cholesterol, disorders
29. Cholesterol as a precursor biochemically important substances (bile acids, hormones) – significance, disorders

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30. Lipoproteins (chylomicrons, VLDL, LDL, HDL) – composition, function, metabolism, disorders
31. General mechanisms of amino acids degradation (deamination, transamination, decarboxylation) and nitrogen balance
32. Glucogenic and ketogenic amino acids – roles in intermediary metabolism
33. Ammonia formation in organism and its fate (transport, detoxication), ureosynthesis (cycle of urea formation) – reactions, importance, disorders
34. Metabolism of amino acids group of pyruvate and oxaloacetate (synthesis, degradation, disorders), involvement of these amino acids to metabolic processes
35. Metabolism of amino acids containing sulphur (synthesis, degradation, disorders), involvement of these amino acids to metabolic processes
36. Metabolism of amino acids group of 2-oxoglutarate and succinyl-CoA (synthesis, degradation, disorders), involvement of these amino acids to metabolic processes
37. Metabolism of aromatic and branched amino acids (synthesis, degradation, disorders) involvement of these amino acids to metabolic processes
38. Biogenic amines and polyamines (precursors of synthesis, reactions, degradation, significance)
39. Biosynthesis and degradation of pyrimidine nucleotides – reactions, regulation, importance, disorders
40. Biosynthesis and degradation of purine nucleotides – reactions, regulation, importance, disorders, salvage reactions

## **II. The molecular biochemistry and organ biochemistry**

1. Compartmentalization of biochemical processes on cellular level.
2. Structure, composition and properties of cell membranes. Transport of substances through the membrane
3. Structure and function of nucleic acids. Genetic code and its properties
4. Organisation of prokaryotic, eukaryotic and mitochondrial genome. The laboratory methods use NA (e.g. restriction enzymes, sequencing, PCR)
5. Replication of DNA in eukaryotic and prokaryotic cells, regulation, inhibition. Reparations of DNA, significance, limitations
6. Transcription of DNA. Regulation of gene expression on the level of transcription, inhibitors
7. Specifications of biosynthesis of mRNA, rRNA and tRNA
8. Proteosynthesis in prokaryotic, eukaryotic cells and in mitochondria. Inhibition of proteosynthesis by exogenic substances.
9. Posttranslational modifications of proteins. Protein folding and chaperones – post synthetic processes
10. Biochemical processes in digestion and absorption of saccharides and lipids – role in the diet
11. Biochemical processes in digestion and absorption of proteins (proteolytic enzymes) – role in the diet, disorders
12. Mutual relation in metabolism of saccharides, lipids and proteins
13. Metabolism of heme – synthesis, degradation, disorders
14. Vitamins soluble in lipids and in water (biochemical importance, function)
15. Metabolism of water and its function in living systems. Hormonal regulation of water and mineral metabolism
16. The blood, composition and function – biochemical view
17. Blood plasma proteins – composition, function, significance
18. Buffer systems of organism, function and importance for acid-base balance
19. Metabolism of erythrocytes
20. Biochemical mechanism of hem coagulation, the role of thrombocytes

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21. Transport of O<sub>2</sub> and CO<sub>2</sub> – biochemical mechanisms and disorders
22. Defects of acid-base balance (e.g. the role of lungs, kidneys)
23. Catecholamines – synthesis, degradation, significance
24. Hormones with receptors on surface of cells – chemical structure, function in the regulation
25. Hormones with intracellular receptors – chemical structure, function in the regulation
26. Membrane receptors, types and roles of second messengers (e.g. cAMP, Ca<sup>2+</sup>)
27. Biochemistry of liver. The options of biochemical diagnostics of damage of hepatocytes and liver function
28. Metabolism of xenobiotic – types of biotransformation reactions, their importance, disorders
29. Biochemistry of kidney; the options of biochemical diagnostics of damage of nephrons and kidney functions (clearance)
30. Neurotransmitters, biochemistry of nervous tissue and senses (e.g. receptors of smell, taste)
31. Contraction and relaxation of muscle; markers of damage of muscle tissue
32. Biochemistry of skeletal, heart and smooth muscle; mechanisms of ATP replenishment in muscle
33. Urine – physiological and pathological parts, diagnostic use
34. Factors affecting reliability of biochemical results and their interpretation
35. Clinical biochemistry (biological material, importance)

### **III. The oral biochemistry**

1. Digestion in mouth
2. Biochemistry of connective tissue, the types and cells of connective tissue
3. Synthesis and degradation of collagen, collagen abnormalities
4. Elastin, structure and function
5. Interfiber of connective tissue, glycosaminoglycan's
6. Metabolism of proteoglycans
7. Basal membranes, laminins
8. Role of fluorides in the metabolism tooth
9. Composition and metabolism of mineral part of teeth and bones
10. Composition and metabolism of organic part of teeth and bones
11. Vitamin D – synthesis, function, diagnostic significance of vitamin D, determination, disorders
12. Calcium – metabolism, factors influencing its absorption, significance, metabolic disorders
13. Calcium in the blood – factors regulating its level in the blood, the role of PTH, vitamin D and calcitonin
14. Metabolism of phosphorus
15. Mineralisation and demineralisation of bones
16. Factors affecting mineralisation and demineralisation
17. Differences in chemical composition of enamel and dentine
18. Formation and composition of dental plaque
19. Dental caries formation and prevention of dental caries
20. Requirements of healthy diet, basal metabolism
21. The role of diet in the process dental caries formation and in prevention of formation of caries
22. Saliva – composition, creation, function, significance
23. The function of saliva proteins (e.g. statherin, mucins, proline rich proteins, lactoferrin)
24. Salivary peroxidase system, sialolithiasis – salivary stone
25. Dental hygiene, active ingredients in toothpastes and mouthwashes