Examination of Biochemistry and Pathobiochemistry

Dentistry program, academic year 2025/2026

The examination of the subject Biochemistry and Pathobiochemistry is oral and consists of two separate parts:

1. Biochemistry and pathobiochemistry
Student tosses three questions: two from the first category and one from the second category of questions (see below)

2. Dental materials
Student tosses one question from the third category

EXAM QUESTIONS

First category: Biochemistry and pathobiochemistry

1. Solutions. Solubility of substances and its significance in biology and biochemistry.
2. Important functional groups in structure of biomolecules and their reactivity.
3. Acid-base reactions and their significance in medicine. Most important disorders of body acid-base balance.
4. Regulation of water and mineral metabolism and its most important disorders.
5. Amino acids – overview, properties, and significance in metabolism.
6. Structure of proteins, chemical bonds and interactions that are involved.
7. Enzymes – classification, mechanism of action, regulation of activity.
8. Biologic oxidation, the respiratory chain and oxidative phosphorylation.
9. The citric acid cycle – key reactions, significance in metabolism.
10. Lipids, their classification, structure and biological significance. Biomembranes.
11. Fatty acids, their classification, and significance.
12. Biosynthesis and degradation of fatty acids and triacylglycerols.
13. Prostaglandins, prostacyclins, thromboxanes, and leukotrienes – origin and significance.
14. Cholesterol, its biosynthesis and excretion.
15. Lipoproteins – overview, metabolism, and significance.
16. Disorders of lipid metabolism. Atherosclerosis.
17. Bile acids, their synthesis and role in digestion.
18. Saccharides – structure, classification and biological significance.
19. Digestion of saccharides. Metabolism of glycogen.
20. Glycolysis and gluconeogenesis.
21. Relationships of saccharide metabolism to metabolism of lipids and proteins.
22. Pathobiochemical processes in diabetes mellitus.
23. Proteosynthesis and protein degradation.
24. Degradation of amino acids, transamination, deamination, the urea cycle.
25. Conversion of amino acids to biologically active metabolites.
26. Differences between metabolism in fed state and in fasting, production and utilization of ketone bodies.
27. Biochemistry and pathobiochemistry of purines and pyrimidines.
28. Porphyrins and bile pigments. Metabolism of heme.

29. Structure and biosynthesis of nucleic acids.
30. Transcription and translation.
31. Techniques used in molecular biology.
32. Proteohormones and peptidic hormones – major members and significance.
33. Steroid hormones – biosynthesis, major members, biological significance.
34. Hormones of adrenal medulla – structure, synthesis and effects.
35. Mechanism of action of hydrophilic hormones – membrane receptors, second messengers, molecular switches.
36. Mechanism of action of lipophilic hormones. Signaling to the cell nucleus, potential of tissue engineering.
37. Blood plasma proteins – significance, major members, methods of estimation.
38. Characteristics of antigens and antibodies.
39. Immunoglobulins – structure, classification, biological significance. The antibody immune response and its course. Monoclonal antibodies.
40. Immunochemical techniques and their significance in medicine.
41. Jaundice (icterus) and its most common causes.
42. Overview of the main biochemical processes in the liver and their disorders.
43. Biochemical examination of liver.
44. Nutrition and its significance for health.
45. Vitamins, their significance for metabolism and consequences of their deficiencies.
46. Mineral components in the diet and their biological significance.
47. Toxic effects of metals, especially heavy metals, on living organisms.
48. Metabolic alterations caused by ethanol and their consequences.
49. Mechanisms of poison actions.
50. Selected methods used in biochemistry – principle and usage (spectrophotometry, chromatography and electrophoresis).
51. Biochemical features of tumor growth.
52. Chemical structures of basic antimicrobial substances.

Second category: Biochemistry and pathobiochemistry of oral cavity

1. Composition of saliva. Protective function of saliva in mouth cavity.
2. Buffers in saliva, their composition and significance.
3. Proteins in saliva.
4. Main components of connective tissue.
5. Collagen and elastin – structure, synthesis and degradation.
6. Chemical composition of tooth and bones.
7. Calcium, its metabolism and biological significance.
8. Hormones that regulate metabolism of calcium.
9. Mineralization of hard tissues, conditions necessary for its development.
10. Osteoporosis and other metabolic bone diseases. Biochemical markers of bone remodeling.
11. Biochemistry of blood coagulation.
12. Disorders of blood coagulation. Substances with anticoagulant effects.
13. Inflammatory reaction and associated biochemical processes, significance in dentistry.
14. Acute phase reaction and acute phase proteins, significance in dentistry. Complement, its activation and significance.
15. Pathobiochemistry of reactive oxygen and nitrogen species. Phagocyte weapons.
16. Dental plaque – characteristics, structure, formation, and consequences of its presence.

17. Biochemical conditions for formation of tooth decay.
18. Biochemical conditions for formation of dental erosion.
19. Role of saccharides in origin of tooth decay. Metabolism of sucrose by oral bacteria.
20. Artificial sweeteners and their significance in dentistry.
21. Significance of fluoride in prevention of tooth decay.
22. Plant substances used in dentistry. Alkaloids.
23. Chemical nature and mechanism of action of the active components in dentifrices.
24. Chemical nature and mechanism of action of the inactive components in dentifrices.

Third category: Dental materials

1. Characteristics of dental metallic materials (metallic bond, crystal structure, crystallization process).
2. Classification of dental metals and alloys.
3. Dental alloys of noble and base metals.
4. Casting dental alloys (technique, types of investment materials).
5. Dental amalgams.
6. Structure and properties of polymers, usage of polymers in dentistry.
7. Polymerization reactions used in preparation of synthetic polymers as dental materials.
8. Polymethylmethacrylate and copolymers of methylmethacrylate (properties and usage in dentistry).
9. Classification of composite materials according to filler particle size, their properties.
10. Composition of composite materials.
11. Initiators of photopolymerization and chemical polymerization of composite materials.
12. Classification of adhesive systems, bonding mechanisms.
13. Composition of adhesive systems.
14. Overview of dental cements, classification according to composition and setting reaction.
15. Zinc phosphate, zinc oxide/polycarboxylate and calcium silicate cements.
16. Salicylate, phenolate and resin cements.
17. Glass ionomer cements, resin-modified glass ionomer cements.
18. Classification of impression materials and their characteristics. Rigid impression materials.
19. Hydrocolloid impression materials (alginate, agar).
20. Elastomeric impression materials (polyethers, silicones, polysulfides).
21. Casting materials (dental gypsum, epoxides and polyurethanes).
22. Classification, structure, and properties of dental ceramic materials.
23. Feldspathic and leucite ceramics. Fabrication of metal-ceramic dental restorations.
24. Lithium disilicate a zirconium ceramics.
25. Influence of the oral cavity environment on restorative dental materials.

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