

Pathological Physiology - Examination Questions

The exam focuses on the knowledge of etiology and pathogenesis of diseases and functional disturbances. Symptoms, signs, and diagnostic approaches should be interpreted in relation to the pathologic physiology. Students should have two examples ready to the questions asking for examples. Where asked about specific terms, have definitions of the terms ready. Use pathological-physiological descriptions and not those pathological-anatomical. Diagnostic procedures and their significance are discussed as well.

Part I. General pathological physiology

1. Explain definitions of terms: symptom, syndrome, disease, etiology, and pathogenesis. Give examples.
2. Compensation of a functional disturbance. Decompensation. Functional insufficiency and failure. Give examples.
3. Multifactorial and polygenic disease etiology. The significance of gene polymorphism. Epigenetics. Give examples of molecular mechanisms.
4. Mechanisms of malignant cell transformation. The instability of the genome.
5. Diseases due to mitochondrial dysfunction. Heteroplasmy and mosaicism.
6. Functional consequences of gene mutations. Pathologic gene variants. Monogenic (Mendelian) inheritance. Give examples of molecular mechanisms in the development of monogenic disease.
7. Cellular signaling pathways and their disorders, give examples (cAMP, insulin pathway, kinases, membrane receptors, transmembrane proteins, and others).
8. Damage of the organism caused by electric current.
9. Damage of the organism caused by light, ultraviolet and infrared radiation.
10. Damage of the organism caused by ionizing radiation.
11. Damage of the organism caused by heat and by cold. Controlled hypothermia.
12. Changes evoked by immobilization and mechanical forces. Weightlessness and acceleration force.
13. Intoxication by selected chemical agents: explain the pathogenesis of intoxication by carbon mono-oxide (CO), lead (Pb), nitrates (NO₃-), cyanides (CN-) and organic phosphates (OPE).
14. Chemical cancerogenic substances. Give examples of molecular mechanisms in chemical cancerogenesis. Effects of the tobacco smoking.
15. Effects of ethylalcohol on the organism.
16. Toxins of plants and animals. Give examples of molecular mechanisms of intoxications.
17. Toxins of bacteria. Give examples bacteria toxin effect on the organism.
18. Inflammation. Fever.
19. Systemic inflammatory response. Septic shock. Multiple organ failure.
20. Stress and reaction of the organism to stress.
21. Allergy. Anaphylactic reaction.
22. Post-transplantation immune-mediated complications, graft versus host disease (GvHD) and HvGD.
23. Autoimmune diseases and immunopathologies.
24. Inborn and acquired immune deficits.
25. Dehydration of the organism.
26. Hyperhydration of the organism. Edema and ascites.

27. Hypoxia. Classification of hypoxias. Cell response to hypoxia. Cell, tissue, and systemic hypoxia compensation responses.
28. Oxygen toxicity. Physiological basis of oxygen and hyperbaric therapy.
29. Tissue ischemia and redistribution of blood flow. Reperfusion damage of the tissue.
30. Acidification of the internal environment. Definitions and examples.
31. Alkalization of the internal environment. Definitions and examples.
32. Cell death in disease pathogenesis.
33. Regeneration and reparation of tissues. Wound healing.
34. Tumor growth. Tumor metastasis and changes in its properties.
35. Interaction of tumor with the organism. Paraneoplastic syndromes.
36. Insufficient food intake (causes and consequences). Starvation. Catabolic states.
37. Etiology and pathogenesis of obesity. Complications of the obesity.
38. Deficits of water-soluble vitamins.
39. Deficits of fat-soluble vitamins. Hypervitaminoses.
40. Disorders of lipid metabolism. Hyperlipoproteinemia.
41. Etiology and pathogenesis of hyperbilirubinemia.
42. Disturbances in purine metabolism.
43. Disturbances in heme and porphyrin metabolism.
44. Disturbances in the balance and distribution of sodium, chlorides and potassium.
45. Disturbances in the balance and distribution of calcium, magnesium and phosphates.
46. Disturbances in the balance and distribution of iron, copper and other trace elements.
47. Inflammation, homeostasis and metabolism in young age.
48. Disturbances of growth and development.
49. Ageing. Diseases in old age. Death of the organism.
50. Defects in cellular signal transduction. Receptor and postreceptor defects. Give examples.

Part II. Pathological physiology of the organ system diseases.

BLOOD

51. Functional consequences of anemia. Anemic syndrome.
52. Classification of anemias based on the pathogenesis.
53. Iron deficiency anemia. Anemia of chronic disease.
54. Anemias caused by folic acid and vitamin B12 deficiency. Anemia in chronic kidney disease.
55. Hemolytic anemias.
56. Hemoglobinopathies. (Sickle cell anemia. Thalassemia.)
57. Chronic myeloproliferative diseases.
58. Acute leukaemias (Acute myeloid leukemia, acute lymphocytic leukemia).
59. Reactive bone marrow responses (secondary polycythemia, reticulocytosis, leukocytosis).
60. Failure of hematopoiesis. Aplastic anemia.
61. Myelodysplastic syndrome.
62. Chronic lymphocytic leukemia. Lymphomas (basic classification and pathogenesis).
63. Multiple myeloma (plasmacytoma).
64. Hematopoietic stem cell. Pathophysiology of bone marrow transplantation.
65. Complications of blood transfusion.
66. Hemorrhagic diatheses – etiology and pathogenesis.

67. Pathophysiology of thrombocytopenia and thrombocytopathies.
68. Vasculopathies (classification and effect on hemostasis).
69. Coagulopathies.
70. Disseminated intravascular coagulopathy (DIC).
71. Hypercoagulable states (thrombophilia).
72. Hypersplenism. Splenomegaly.
73. Hemolytic disease of newborn. Extramedullar hemopoiesis.

HEART AND CIRCULATION

74. Etiology and pathogenesis of the arterial hypertension.
75. Consequences of arterial hypertension.
76. Pulmonary hypertension.
77. Arterial hypotension. Circulatory collapse.
78. Circulatory shock. Shock classification.
79. Congenital heart defects. Hemodynamic consequences of right-to-left and left-to-right cardiac shunts.
80. Cardiovascular disorders in young age.
81. Stenosis and insufficiency of the mitral valve.
82. Stenosis and insufficiency of the aortic valve.
83. Cardiomyopathies.
84. Disturbances of the myocardial blood supply. Angina pectoris.
85. Myocardial infarction.
86. ECG changes in myocardial ischemia and myocardial infarction. Explain the mechanisms.
87. Consequences and complications of myocardial infarction.
88. Constrictive pericarditis. Cardiac tamponade.
89. Definitions and classification of heart arrhythmias.
90. Etiology and pathogenesis of arrhythmias (local and systemic factors).
91. Mechanism of abnormal impulse formation in development of cardiac arrhythmias.
92. Mechanism of conduction disturbance in development of cardiac arrhythmias.
93. Sinus and supraventricular arrhythmias.
94. Ventricular arrhythmias.
95. Effect of arrhythmias on cardiac and systemic blood flow.
96. Effect of kalemia, natremia and calcemia on myocardial impulse formation and conduction. Manifestations on ECG.
97. Heart failure (causes, classification, and consequences).
98. Compensatory mechanisms of heart failure.
99. Pathologic changes in cardiac output (low cardiac output, hyper-kinetic circulation)
100. Left heart failure.
101. Right heart failure. Cor pulmonale.
102. Atherosclerosis (causes and consequences). Endothelial activation and dysfunction.
103. Thromboembolic disease.
104. Venous insufficiency. Disorders of the lymphatic drainage.

LUNG AND RESPIRATION

105. Protective breathing reflexes. Cough. Sneezing. Inflation reflex and other reflexes.
106. Aspiration of objects and fluids into the lungs. Upper respiratory tract obstruction.
107. Respiratory insufficiency.
108. Alveolar hypoventilation.
109. Disturbances of the ventilation to perfusion ratio.
110. Disorders of gas diffusion through the alveolo-capillary membrane
111. Restrictive lung disorders. Lung fibrosis.
112. Obstructive lung disorders.
113. Pathophysiology of the chronic obstructive broncho-pulmonary disease (COBPD).
114. Pathophysiology of the bronchial asthma.
115. Pulmonary atelectasis. Lung edema. Pneumonia.
116. Acute lung failure. Acute Respiratory Distress Syndrome.
117. Pneumothorax.
118. Pulmonary embolization (causes and consequences).
119. Mechanical support of lung ventilation (basic principles and goals).
120. Pathophysiology of respiratory disorders in children (RDS and others).

KIDNEYS AND URINARY TRACT

121. Disturbances of urine production and output (oliguria, anuria, polyuria, isosthenuria, dysuria).
122. Prerenal, renal, and postrenal causes of renal function defects.
123. Disturbances of glomerular function.
124. Nephrotic and nephritic syndromes.
125. Acute tubular injury and necrosis. Congenital and acquired tubular dysfunctions.
126. Acute renal injury. Acute renal failure.
127. Chronic kidney disease. Chronic renal failure. Uremia.
128. Glomerular and tubular function defects in the chronic renal failure.
129. Systemic effects of the chronic renal failure.
130. Disorders affecting concentration and dilution functions of the kidneys (water and osmotic diuresis, renal tubular acidosis).
131. Urolithiasis. Disturbances of urinary bladder emptying.

GASTROINTESTINAL TRACT

132. Disorders of oral cavity. (dental caries, periodontal disease, salivary gland disorders).
Manifestation of systemic diseases in oral cavity.
133. Disorders of the swallowing and passage of the food in the esophagus (dysphagia).
134. Gastro-oesophageal reflux.
135. Disorders of gastric motility. Disturbances of gastric secretion.
136. Nausea and vomiting. Their diagnostic significance. .
137. Postprandial syndromes. (Acute and chronic dumping syndrome.)
138. Gastritis.
139. Gastric and duodenal ulcer disease.

140. Acute and chronic gastritis. Disorders of the exocrine pancreas.
141. Acute intestinal obstruction. Ileus.
142. Diarrhea and constipation.
143. Malabsorption syndromes.
144. Coeliac disease. Inflammatory bowel diseases (Crohn's disease, ulcerative colitis).
145. Gastrointestinal bleeding. Colonic polyps. Colorectal carcinoma.
146. Functional disorders of the large bowel. Irritable bowel syndrome. Constipation.
147. Hepatitis. Liver toxic damage. Liver steatosis.
148. Liver cirrhosis.
149. Hepatic failure. Hepatic portosystemic encephalopathy.
150. Cholestasis.
151. Ascites. Hepatorenal syndrome.
152. Disorders of the gall bladder and tractus choledochus. Cholelithiasis.
153. Characteristic features of gastrointestinal disorders in young age.

ENDOCRINE SYSTEM

154. Primary and secondary endocrine disturbances. Classification of endocrine disorders
155. Give examples of receptor and gland disorders.
156. Disturbances of the hypothalamo-hypophyseal axis.
157. Hypopituitarism.
158. Hyperpituitarism.
159. Hyperthyroidism.
160. Hypothyroidism. Goiter.
161. Hypoparathyroidism and hyperparathyroidism.
162. Hyperaldosteronism. Renin-angiotensin-aldosterone in disease pathogenesis.
163. Hypercortisolism. Etiopathogenetic classification of the Cushing's syndrome.
164. Adreno-genital syndrome.
165. Hypocortisolism. Addison's disease.
166. Pheochromocytoma.
167. Type 1 diabetes mellitus.
168. Type 2 diabetes mellitus. Metabolic (Reaven's) syndrome.
169. Prediabetes, diabetes, their classification and causes. Markers of diabetes compensation.
170. Acute complications of diabetes mellitus. Diabetic coma.
171. Chronic complications of diabetes mellitus
172. Disturbances of sexual differentiation in development. Hypogonadism.
173. Disorders of the menstrual cycle. The polycystic ovary syndrome.
174. Causes of male infertility and age-related fertility decline.
175. Causes of female infertility and menopause.
176. Endocrine disorders in young age and adolescence (diabetes, thyroopathies and others).

NEURAL SYSTEM

177. Disorders of the neuromuscular junction.
178. Disorders of motor neurons.

179. Peripheral neuropathies. Damage and regeneration of peripheral nerve.
180. Spinal cord lesions.
181. Disorders of the basal ganglia. Parkinson's disease. Hyperkinetic disorders.
182. Cerebellar disorders.
183. Demyelination. Multiple sclerosis.
184. Disorders of cognitive functions. Dementias. Aphasias.
185. Disorders of consciousness. Consequences of the head injury and the brain damage.
186. Sleep disorders.
187. Disturbances of the cerebral circulation. Cerebral edema. Intracranial hypertension.
188. Hydrocephalus. Changes in cerebrospinal fluid composition.
189. Vestibular disorders.
190. Disorders of vision.
191. Disorders of hearing.
192. Pain.
193. Disorders of the autonomic nervous system.
194. Seizures and convulsions. Epilepsy and migraine.
195. Neural disorders in young age and adolescence.

BONE, CONNECTIVE TISSUE, SKELETAL MUSCLES

196. Osteomalacia. Rickets. Renal osteodystrophy.
197. Bone fractures. Disturbances in bone fracture healing. Osteoporosis.
198. Disturbances of skeletal muscle contraction. Cramps. Tetany.
199. Muscle atrophy and hypertrophy. Myopathy. Rhabdomyolysis.
200. Systemic lupus erythematosus. Rheumatoid arthritis. Scleroderma.

Part III. Case studies as questions

Questions below are related to case studies and pathological basis of diagnostic procedures. These questions can be used as part of case studies questions.

201. Blood cells examination.
202. Laboratory tests for iron stores and iron availability.
203. Laboratory indicators of hemolysis.
204. Blood tests preceding blood transfusion.
205. Diagnostic tests for bleeding disorders.
206. Coagulation tests.
207. Tests for hyper-coagulation states.
208. Dysproteinemia, paraproteinemia.
209. Acute phase proteins.
210. Heart catheterization.
211. Measurements of the cardiac output. Cardiac index.
212. Blood pressure monitoring.
213. ECG signs of disordered impulse formation or conduction.

214. ECG manifestations of myocardial ischemia.
215. Exercise stress test.
216. Examination of restrictive and obstructive lung diseases.
217. Lung diffusion capacity, distribution of the lung ventilation and perfusion.
218. Examination of arterial blood gases.
219. Spirometry. Whole body plethysmography.
220. Determination of glomerular filtration rate and renal blood flow.
221. Kidney tubular function tests.
222. Tests for the acid-base balance.
223. Urine and urinary sediment tests (interpretation of results). Proteinuria. Hematuria. Hemoglobinuria. Hemosiderinuria. Urinary casts.
224. Esophago-gastro-duodenoscopy. Diagnostic and therapeutic use.
225. Evaluation of pancreatic secretion.
226. Tests for intestinal malabsorption.
227. Tests for cholestasis.
228. Tests for necrotic and inflammatory processes in the liver.
229. Indicators of the liver proteosynthesis
230. Clinical tests in endocrinology based on the negative feedback control of hormone secretion.
231. Tests for the secondary arterial hypertension.
232. Tests regarding the adeno- and neurohypophysis.
233. Tests regarding the thyroid gland functioning.
234. Tests of the parathyroid gland functioning and calcium and phosphates metabolism.
235. Tests regarding the suprarenal cortex and medulla.
236. Tests regarding sex hormones.
237. Deep tendon reflexes.
238. Evaluation of the state of consciousness.
239. Neurological tests regarding the pyramidal system.
240. Neurological tests regarding the extra-pyramidal system and cerebellum.
241. Neurological tests regarding functioning of the vestibular system.
242. Examination of pain and somato-sensoric perception.
243. Examination of smell and taste.
244. Examination of hearing disorders. Audiogram.
245. Examination of vision disorders. Perimeter.