

## **BIOCHEMISTRY PROBLEMS - TESTS**

1. Histamine is an important regulator of the pH of the gastric juice. Which process is activated by histamine in the parietal cells of the stomach mucous membrane?

1. Hydrochloric acid secretion
2. Glycolysis
3. Proteolysis
4. Pepsin secretion
5. Mucin formation

2. Coffee taken on an empty stomach can lead to gastric ulcer. Which process is activated by caffeine in the parietal cells of the stomach mucosa?

1. It increases hydrochloric acid secretion
2. It activates glycolysis
3. It activates carbonic anhydrase
4. It inhibits glycolysis
5. It decreases mucin secretion

3. A patient with the obstruction of the biliary ducts developed skin hemorrhages, the time of blood clotting increased because of vitamin K deficiency. What is the reason for vitamin K deficiency?

1. Bile acids stop getting into the gastrointestinal tract which causes the disorders in micelles formation
2. The lack of this vitamin in food products
3. The destruction of vitamin K by the enzymes of the gastrointestinal tract
4. The disruption of vitamin K synthesis in the large intestine
5. The inactivation of hydrochloric acid in the stomach

4. Steatorrhea develops due to poor bile secretion or to the decreased secretion activity of the pancreas. Why do these disorders lead to the appearance of lipids in feces?

1. The emulsification and digestion of lipids are disrupted
2. The flow of food from the stomach to the intestines is disrupted
3. The hydrochloric acid secretion in the stomach is disrupted
4. The intestinal microflora influence on food fats decreases
5. The appetite increases and a lot of lipids are excreted with feces

5. A patient who has been taking aspirin for a long time complains of prolonged bleeding after skin cuts and abrasions. Which enzyme inhibition are those changes related to?

1. Cyclooxygenase
2. Triacylglycerol-lipase
3. Phospholipase A<sub>2</sub>
4. Phospholipase C
5. Diacylglycerol-lipase

6. During the medical check-up a patient's tests showed the increased concentration of total cholesterol up to 7,2 mmole/l and the decreased cholesterol of high-density lipoproteins. Which pathology is that?

1. Atherosclerosis
2. Phenylketonuria
3. Fructosuria
4. Andersen's glycogen storage disease
5. Obesity

7. Long starvation increases tissue lipolysis and leads to acidosis. Which metabolites accumulation leads to the acidification of the body internal environment?

1. Ketone bodies
2. Glutamic acid
3. Triacylglycerols
4. Glycogen
5. Palmitic acid

8. Excessive sugars consumption leads to the production of large amounts of acetyl-CoA, dioxyacetonephosphate and NADPH in the liver. It leads to atherosclerosis and obesity. Which processes do these metabolites participate in?

1. Synthesis of triacylglycerols and cholesterol
2. Production of very-low-density lipoproteins and high-density proteins
3. Synthesis of glycerophospholipids and glycogen
4. Production of low-density lipoproteins and intermediate-density lipoproteins
5. Synthesis of palmitic acid and sphingomyelin

9. Athletes may take medications which contain carnitine to increase the working capacity of muscles. Which reactions does carnitine participate in?

1. The transport of a fatty acid to the matrix of mitochondria
2. The transport of a fatty acid through the cytoplasmic membrane
3. The transport of a fatty acid from the matrix of mitochondria to the cytoplasm
4. The transport of a fatty acid to lysosomes
5. The transport of a fatty acid to ribosomes

10. Patients with cachexia have the decreased rate of fatty acids biosynthesis. Why is insulin used to treat this pathology?

1. It activates the dephosphorylation of acetyl-CoA-carboxylase
2. It increases the rate of ketone bodies synthesis
3. It inhibits ketone bodies synthesis
4. It activates the phosphorylation of tissular lipase
5. It activates the mobilization of triacylglycerols

11. The reasons for angina pectoris are ischemia and myocardial hypoxia. Mildronate is prescribed to patients with this disease. Mildronate is an inhibitor of carnitine synthesis and it helps to save oxygen in heart muscle. Which biochemical process rate will be decreased in this case?

1.  $\beta$ -oxidation of fatty acids
2. Lipolysis

3. Fatty acids synthesis
4. Glycolysis
5. Lipogenesis

12. A patient was admitted to hospital after a road traffic accident, the concentrations of urea and creatine in the blood plasma are increased, the level of creatinine is decreased. Creatine is present in urine. Which tissue damage had caused these changes?

1. Skeletal muscle
2. Bone tissue
3. Cartilage
4. Heart muscle
5. Liver

13. A patient complains of pain in small joints, the concentration of uric acids is increased in the blood plasma. Which pathology has these symptoms?

1. Gout
2. Alkaptonuria
3. Phenylketonuria
4. Fructosuria
5. Proteinuria

14. A newborn was diagnosed with hyperammonemia. Which enzyme activity is decreased in the liver?

1. Carbomoylphosphatesynthetase I
2. Glutaminesynthetase
3. Arginase
4. Glutamatedehydrogenase
5. Carbomoylphosphatesynthetase II

15. A girl with progressive mental retardation was examined. Her urine test showed the presence of phenylpyruvate, and the concentration of phenylalanine in the blood plasma was increased. Which pathology has these symptoms?

1. Phenylketonuria
2. Glycosuria
3. Alkaptonuria
4. Alzheimer's disease
5. Hyperammonemia

16. A patient developed an allergic reaction after being injected with a protein-based preparation. Which substance excessive production had caused such a reaction?

1. Histamine
2. Serotonin
3. Gamma-aminobutyric acid
4. Adrenaline
5. Dopamine

17. A patient has no pigments in the skin, hair, iris; he also has impaired vision and photophobia. What is the reason for this pathology?

1. The disorder in melanin synthesis
2. The disorder in thyroxine synthesis
3. The disorder in catecholamine synthesis
4. The disorder in homogentisic acid production
5. The disorder in phenylpyruvate production

18. A patient has ochronosis, arthritis symptoms, the urine becomes of the dark-brown colour after being left in the open air for some time. Which enzyme deficiency leads to this pathology?

1. Homogentisic acid dioxygenase
2. Phenylalaninehydroxylase
3. Tyrosineaminotransferase
4. Fumarylacetoacetatehydrolase
5. *p*-hydroxyphenylpyruvate dioxygenase

19. The general medical examination of a patient showed the skin and mucous membranes pallor and the deep striations on the tongue. The blood test showed the decreased hemoglobin, the decrease in the number of erythrocytes, anisocytosis and poikilocytosis; the gastric juice test showed the decrease of free and bound hydrochloric acid and the decrease of the pH. What is the reason for this pathology?

1. Deficiency of iron and vitamin B<sub>12</sub>
2. Erythrocytes hemolysis
3. Deficiency of vitamins D and K
4. The disruption in the synthesis of the hemoglobin  $\alpha$ -chains
5. The disruption in the synthesis of the hemoglobin  $\beta$ -chains

20. A patient's skin colour is yellowish, so is the colour of the sclerae and mucous membranes, the urine is dark, the feces are colorless. The levels of both direct and indirect bilirubin are increased. The urine test shows the presence of direct bilirubin and urobilinogen. Which pathology has such symptoms?

1. Hepatitis
2. Erythrocytes hemolysis
3. Biliary ducts obstruction
4. Starvation
5. Dehydration

21. A 60-year-old man complained of severe intermittent pains in the epigastrium. The blood and urine tests showed it is not pancreatitis. Imperceptible anemia was detected. The pentagastrin test showed the decreased rates of both basal and maximum HCl secretion. The gastric juice examination: pH -7.0, free HCl – 0, pepsin – 0, blood and lactate are present. Which pathology has such symptoms?

1. Gastric cancer
2. Pancreatitis
3. Hyperacidic gastritis
4. Hypoacidic gastritis

## 5. Non-acidic gastritis

22. An overweight man, aged 45, complained of shortness of breath and the intermittent pains in the heart area. The blood plasma lipids test on an empty stomach showed: total cholesterol - 6,5 mmole/l, cholesterol of high-density lipoproteins - 1,4 mmole/l, triacylglycerol - 8 mmole/l (normal - 1,5-2,5 mmole/l). Which pathology has such symptoms?

1. Obesity and atherosclerosis
2. Fatty liver (steatosis)
3. Cholelithiasis
4. Diabetes mellitus
5. Kidney failure

23. The bile test of a hypersthenic woman showed the high cholesterol level and the increased activity of alkaline phosphatase. Which pathology could lead to such changes?

1. Cholelithiasis
2. Myocardial infarction
3. Fatty liver (steatosis)
4. Diabetes mellitus
5. Atherosclerosis

24. A 40-year-old man complains of the yellowish skin colour. The level of indirect (unconjugated) bilirubin is increased in blood, direct bilirubin is absent in urine. Urobilin in urine and stercobilin in feces are present in large amounts. What is the reason for this type of jaundice?

1. Intense erythrocytes hemolysis
2. Hepatitis
3. Biliary passages obstruction
4. Starvation
5. Dehydration

25. The urine left in the open air turned reddish. Which pathology has such symptoms?

1. Porphyria
2. Iron-deficiency anemia
3. Megaloblastic anemia
4.  $\beta$ -thalassemia
5.  $\alpha$ -thalassemia

26. A patient has a bright-yellow skin colour, itchy skin and colorless feces. The bilirubin is increased in blood plasma (mostly due to direct bilirubin). There is direct bilirubin in urine. What is the reason of this type of jaundice?

1. Obstruction of biliary passages
2. Erythrocytes hemolysis
3. Hepatitis
4. Starvation
5. Dehydration

27. Paracetamol, an anti-fever medication and painkiller, increases the production of reactive oxygen species. If patients have a genetic defect of the enzyme of pentose phosphate pathway, paracetamol may cause hemolytic anemia. Which enzyme absence can lead to this disease?

1. Glucose-6-phosphatedehydrogenase
2. Transketolase
3. Glucose-6-phosphotase
4. Glutamatedehydrogenase
5. 6-phosphogluconolactonase

28. A patient's urine test showed the increased level of 17-ketosteroids. Which hormones disorder had led to such a result?

1. Androgens
2. Insulin
3. Glucagon
4. Calcitonin
5. Vasopressin

29. A patient complains of the decreased body temperature, the increase of the body weight, tiredness and sleepiness. The concentrations of  $T_4$  and  $T_3$  are decreased in blood plasma. Which pathology has such symptoms?

1. Myxedema
2. Diabetes insipidus
3. Hyperthyroidism
4. Diabetes mellitus
5. Addison's disease

30. A patient's x-rays showed bone tissue destruction. The level of ionized calcium is increased in blood plasma, the level of phosphates is increased in urine. Which endocrine gland(s) have disorders in this case?

1. The parathyroid glands
2.  $\beta$ -cells of the pancreas
3. The posterior lobe of the pituitary gland
4. The thyroid gland
5. The adrenal cortex

31. A patient complained of rapid heartbeat, muscle weakness, decreased body weight, increased body temperature. The medical examination showed exophthalmos and the enlarged thyroid gland. Which hormonal changes had caused this pathology?

1. Thyroid hormones (iodothyronines) excess
2. Insulin deficiency
3. Vasopressin deficiency
4. Thyroid hormones (iodothyronines) deficiency
5. Glucocorticoids deficiency

32. A patient complains of general weakness, impaired vision, increased appetite (polyphagia), thirst (polydipsia), frequent urination (polyuria). The check-up showed some sores in the paradontal tissues. The level of glucose in blood is 10 mmole/l, the

concentration of glycated hemoglobin is increased. Which hormone deficiency is this pathology connected with?

1. Insulin
2. Testosterone
3. Thyroxine
4. Estrogen
5. Parathormone

33. People consuming ethanol for a long time develop liver cirrhosis and edemas.

Укажите причину развития отеков What is the reason for edemas?

1. The decrease of albumin in the liver
2. The decrease of transferrin in the liver
3. The decrease of ceruloplasmin in the liver
4. The decrease of kininogen in the liver
5. The decrease of very low-density proteins in the liver

34. People develop edemas if they starve for more than two weeks. It is connected with the breakdown of ..... Explain why

1. albumin
  2. transferrin
  3. ceruloplasmin
  4. kininogen
  5. very low-density proteins
1. chaperones

35. A patient with methanol toxicity is treated with a large amount of ethanol. Explain why such treatment is effective.

1. Ethanol removes methanol from the active site of alcoholdehydrogenase
2. Ethanol activates cytochrome P<sub>450</sub> in hepatocytes
3. Ethanol inhibits alcoholdehydrogenase
4. Ethanol inhibits cytochrome P<sub>450</sub> in hepatocytes
5. Ethanol binds to methanol

36. The medication allopurinol is used to treat gout. Explain the mechanism of action of this medication.

1. It inhibits xanthineoxidase and uric acid is not produced
2. It binds to uric acid and excretes it from a human body
3. It activates xanthineoxidase which breaks down uric acid
4. It inhibits adenosinedeaminase
5. It activates adenosinedeaminase

37. A 4-month-old baby has got rickets symptoms. The digestion is normal. After the proper treatment and sun exposure the symptoms decreased. What is the reason for this disease?

1. Deficiency of vitamin D
2. Deficiency of vitamin E
3. Deficiency of vitamin K

4. Deficiency of vitamin A
5. Deficiency of vitamin F

38. A breastfed baby was prescribed the high dosage of the medication which contained a fat-soluble vitamin. Some time later his fontanelles closed and the baby developed convulsions and headaches. Which vitamin had been the baby taking?

1. Vitamin D<sub>3</sub>
2. Vitamin C
3. Vitamin E
4. Vitamin K
5. Vitamin A

39. A patient who had been taking sulfanilamide medications for a long time to treat a bacterial infection developed megaloblastic anemia which his blood test detected. Which vitamin deficiency could lead to this pathology?

1. Folic acid
2. Vitamin B<sub>1</sub>
3. Pantothenic acid
4. Biotin
5. Vitamin C

40. A patient developed bleeding gums, dermatorrhagia, internal bleeding, increasing tiredness, while also having frequent infections and the lack of fresh vegetables and fruit in the diet. Which disorder leads to these symptoms?

1. Hydroxylation of lysine and proline residues
2. Carboxylation of glutamate residues
3. Phosphorylation of serine residues
4. Deamination of lysine residues
5. Decarboxylation of glutamate and aspartate residues

41. A patient has a hereditary hemolytic anemia caused by the high content of reactive oxygen species and the disorders in the production of NADPH. Which enzyme deficiency in erythrocytes leads to this pathology?

1. Glucose-6-phosphatedehydrogenase
2. Hexokinase
3. Phosphofructokinase
4. Aldolase
5. Lactatedehydrogenase

42. When barbiturates are consumed for a long time their dose should be increased with time. Explain the reason for this phenomenon.

1. Activation of microsomal oxidation
2. Inhibition of microsomal oxidation
3. Dissociation between the electron transport chain and oxidative phosphorylation
4. Inhibition of Complex IV of the electron transport chain
5. Inhibition of Complex I of the electron transport chain

43. Quick-Pytel test is used to study the detoxifying function of the liver. Which



substance participates in the conjugation with benzoic acid?

1. Glycine
2. PAPS
3. Glucuronic acid
4. Taurine
5. Histidine

44. During the large intestine inflammation the level of animal indican in urine increases sharply. Which process leads to the production of animal indican?

1. Detoxification of the products of tryptophan decay
2. Oxidative deamination of lysine
2. Conjugation of benzoic acid with glycine
4. Detoxification of the products of tyrosine decay
5. Oxidative deamination of arginine

45. Alcohol and drug addicts need a higher dose of anesthetic during surgeries. Which processes do ethanol and narcotic substances induce?

1. Microsomal oxidation
2. Cellular (tissular) respiration
3. Glutathione oxidation
4. Phagocytosis
5. Krebs cycle

46. A patient was diagnosed with atherosclerosis. The doctor prescribed the medication lovastatin in minimum dosage to decrease the level of cholesterol in blood. A week later the level of cholesterol was normal again. The patient continued taking the medication but three months later the level of cholesterol was again much higher than normal. Which enzyme synthesis was induced by the hydrophobic medication lovastatin?

1. cytochrome P<sub>450</sub>
2. HMG-CoA- synthase
3. cholesterolesterase
4. lecithincholesterolacyltransferase
5. HMG-CoA-reductase

47. Large doses of vitamin C are recommended during the periods of emotional and physical tension. Explain it, it is known that vitamin C.....

1. It participates in hydroxylation during the synthesis of adrenaline and glucocorticoids which are stress hormones
2. It participates in hydroxylation of proline residues during collagen synthesis
3. It participates in hydroxylation of lysine residues during collagen synthesis
4. It participates in hemoglobin synthesis
5. It prevents active HS-groups of proteins from oxidation

48. A patient has dizziness, headaches, shortness of breath, rapid heartbeat and limb pains. The blood test shows elongated, half-moon shaped erythrocytes. What is the reason for this disease?

1. A mutation in the primary structure of hemoglobin

2. The lack of the enzyme glutathione reductase in erythrocytes
3. The lack of the enzyme superoxide dismutase in erythrocytes
4. The lack of the enzyme glutathione peroxidase in erythrocytes
5. The lack of the enzyme methemoglobin reductase in erythrocytes

49. A patient has intensive skin pigmentation, cachexia, muscle weakness. The concentration of glucose, sodium and chloride ions is decreased and the concentration of potassium ions is increased in blood plasma. Which pathology has such symptoms?

1. Addison's disease
2. Diabetes mellitus
3. Diabetes insipidus
4. Hyperthyroidism
5. Hypothyroidism

50. A 40-year-old man has disproportionate enlargement of the face, hands, feet, skull, the enlargement of the internal organs. The blood plasma test shows high levels of aminoacids: valine, leucine, isoleucine. Which hormonal changes have caused this pathology?

1. The excess of somatotropin in adulthood
2. The excess of somatotropin in childhood
3. The excess of thyroid hormones (iodothyronines)
4. The excess of parathormone
5. The excess of testosterone

51. A patient has dizziness, headaches, shortness of breath, rapid heartbeat and limb pains. The blood test shows elongated, half-moon shaped erythrocytes. What is the reason for this disease?

1. A mutation in the primary structure of hemoglobin
2. The lack of the enzyme superoxide dismutase in erythrocytes
3. The lack of the enzyme glutathione peroxidase in erythrocytes
4. The lack of the enzyme glutathione reductase in erythrocytes
5. The lack of the enzyme methemoglobin reductase in erythrocytes

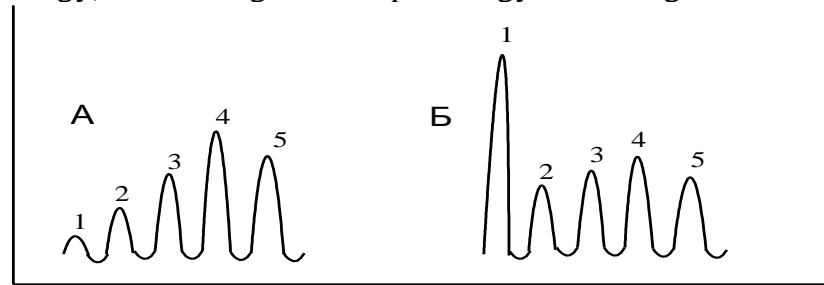
52. The proteins of nucleosomes move to the cathode when the pH is 7. It occurs because the protein part of nucleosomes contains a lot of residues of these aminoacids ....

1. arginine and lysine
2. leucine and valine
3. alanine and glycine
4. glutamic acid and aspartic acid
5. serine and threonine

53. When the pH is 7 the serum albumin moves to the anode in the electric field. It happens because the albumin molecule has a lot of aminoacids residues of .....

1. aspartic acid and glutamic acid
2. proline
3. serine and threonine
4. aminoacids with non-polar radicals
5. lysine and arginine

54. Compare the electrophoretograms of the lactate dehydrogenase isoenzymes (A - norm, Б - pathology). Which organ has a pathology according to these changes?



1. Myocardium
2. Pancreas
3. Kidneys
4. Bone tissue
5. Liver

55. A laboratory assistant placed a test tube with blood into the thermostat at 70°C for a faster clot formation. When the blood serum was examined they found out that the enzymes had zero activity. Explain what had happened to the enzymes of the blood serum.

1. Heat denaturation of enzymes
2. The complexes between the enzymes formed
3. The complexes enzyme-inhibitor formed
4. The pH of the media changed
5. There were not enough substrates

56. A poultry factory worker who had been consuming 5 and more raw eggs daily developed lassitude, sleepiness, muscle pain, hair loss, seborrhea. What is the reason for this condition?

1. Biotin deficiency
2. Thiamine deficiency
3. Folic acid deficiency
4. Pantothenic acid deficiency
5. Ascorbic acid deficiency

57. A patient has asymmetric dermatitis on the back of the hands, on the neck and face, and also stomatitis. The patient complains of nausea, stomachache, diarrhea, the lack of appetite, headaches, depression. What is the reason?

1. Vitamin PP deficiency
2. Vitamin B<sub>1</sub> deficiency
3. Vitamin B<sub>2</sub> deficiency
4. Vitamin B<sub>12</sub> deficiency
5. Vitamin B<sub>6</sub> deficiency

58. Warfarin, antivitamin K, is used to inhibit blood clotting during thrombosis and some other pathologies. Which enzyme activity does this medication decrease?

1. Gamma-glutamylcarboxylase
2. Cathepsin B
3. Hexokinase
4. Pyruvatecarboxylase

## 5. Cyclooxygenase

59. A patient who had been taking sulfanilamide medications for a long time to treat a bacterial infection developed megaloblastic anemia which his blood test detected. Which vitamin deficiency could lead to this pathology?

1. Folic acid
2. Vitamin B<sub>1</sub>
3. Pantothenic acid
4. Biotin
5. Vitamin C

60. A woman who had been consuming fresh carrot juice in large amounts in order to lose some weight addressed a doctor complaining of the orange skin colour, tiredness, nausea, occasional vomiting. What did the blood test show?

1. The increased level of carotene in blood plasma
2. The increased level of iron in blood plasma
3. The decreased level of iron in blood plasma
4. The increased level of vitamin D<sub>3</sub> in blood plasma
5. The decreased level of vitamin D<sub>3</sub> in blood plasma

61. Barbiturates have a hypnotic (sedative/ sleeping) effect. Which enzyme activity in the cell do they block?

1. Complex I of the electron transport chain
2. Acylcarnitinetransferase I
3. Na<sup>+</sup>,K<sup>+</sup>-ATPase
4. Complex IV of the electron transport chain
5. Complex V of the electron transport chain

62. The much advertised face lotion with coenzyme Q<sub>10</sub> improves the respiration of the skin cells. Which process does coenzyme Q<sub>10</sub> participate in?

1. In the transfer of electrons to Complex III of the electron transport chain
2. In glycolysis reactions
3. In fatty acids synthesis
4. In glycogen synthesis
5. In the reactions of the Krebs cycle

63. A patient has a hereditary hemolytic anemia caused by the high content of reactive oxygen species and the disorders in the production of NADPH. Which enzyme deficiency in erythrocytes leads to this pathology?

1. Glucose-6-phosphatedehydrogenase
2. Hexokinase
3. Phosphofructokinase
4. Aldolase
5. Lactatedehydrogenase

65. An elderly person had indigestion (nausea, vomiting, diarrhea) after drinking some milk. These symptoms disappeared after this person had eaten some fermented milk products. What is the possible reason for this condition?

1. The lack of lactase
2. The lack of  $\alpha$ -amylase
3. The lack of maltase
4. The lack of sucrase
5. The lack of pepsin

66. A young child with normal development had continuous diarrhea, vomiting and stomachache after a meal. Milk was cut out from his diet but it was no use. After the sucrose intake the glucose level in blood increased a little. Which enzyme absence can lead to such symptoms?

1. Sucrase
2. Lactase
3.  $\alpha$ -amylase
4. Maltase
5. Pepsin

67. Food products containing starch are usually salted. What is the role of sodium ions in starch digestion?

1. They participate in glucose absorption
2. They activate maltase
3. They activate isomaltase
4. They participate in HCl production
5. They activate  $\alpha$ -amylase

68. Food products containing starch are usually salted. What is the role of chloride ions in starch digestion?

1. They activate  $\alpha$ -amylase
2. They activate maltase
3. They activate isomaltase
4. They activate lactase
5. They participate in glucose absorption

69. Stress leads to the high levels of stress hormones (adrenaline and cortisol) in blood. Which process of carbohydrate metabolism do these hormones stimulate?

1. Gluconeogenesis
2. Glycolysis
3. Pentose phosphate pathway of glucose catabolism
4. Aerobic glucose catabolism
5. Mobilization of glycogen

70. Explain the antibacterial effect of tetracycline.

1. It inhibits the binding of aa-tRNA and the A-site of ribosomes
2. It inhibits Complex I of the electron transport chain
3. It dissociates the electron transport chain and oxidative phosphorylation
4. It inhibits the processes of glucose utilization
5. It activates proteolysis in microorganisms