

**FEDERAL STATE BUDGET EDUCATIONAL INSTITUTION OF HIGHER
EDUCATION
"ROSTOV STATE MEDICAL UNIVERSITY" OF THE MINISTRY OF HEALTH
OF THE RUSSIAN FEDERATION**

FACULTY OF TREATMENT AND PREVENTION

Evaluation materials for
the discipline "Biochemistry"

specialty 05/31/01 General Medicine

1. List of competencies formed by the discipline (in full or partially)*

general professional (OPK):

Code and name general professional competence	Achievement indicator(s) general professional competence
OPK-4 Able to use medical devices provided for in the procedure for providing medical care, as well as conduct examinations of the patient in order to establish a diagnosis.	ID-1 OPK-4 Able to use medical devices in diagnostic studies provided for in the procedures for providing medical care ID-2 OPK-4 Able to apply diagnostic methods, including the use of instrumental methods, when examining a patient in order to establish a diagnosis

2. Types of assessment materials in accordance with formed competencies

Name competencies	Types of assessment materials	number of tasks for 1 competency
OPK-4	Closed tasks	25 with sample answers
	Open type tasks: Situational tasks Interview questions Addition tasks	75 with sample answers

OPK-4:

Exercise 1. Instructions. Instead of a dash, enter only one word.

The proenzyme is converted to its active form by _____
proteolysis.

Response standard: partial.

Task 2. Instructions. Instead of a dash, enter only one word. Low molecular weight substances that reduce enzyme activity are called _____.

Response standard: inhibitors.

Task 3. Instructions. Instead of a dash, enter only one word.

Reversible inhibition is called _____ inhibition if the inhibitor and substrate bind to different centers of the enzyme.

Response standard: non-competitive.

Task 4. Instructions. Instead of a dash, enter only one word.

Reversible inhibition is called _____ inhibition if the inhibitor and substrate bind to the active site of the enzyme.

Response standard: competitive.

Task 5. Instructions. Instead of a dash, enter only one word. Lipids resynthesized in the cells of the small intestine, further _____ are transported mainly as part of _____.

Response standard: chylomicrons

Task 6. Instructions. Instead of a dash, enter only four words. Lipids synthesized in hepatocytes are transported to other tissues in the composition _____.

Response standard: very low density lipoprotein (VLDL)

Task 7. Instructions. Instead of a dash, enter only one word.

Ketone bodies, the synthesis of which in the body increases during fasting, perform _____ function.

Response standard: energy

Task 8. Instructions. Instead of a dash, enter only one word.

Ketone bodies include acetoacetate, β -hydroxybutyrate and _____.

Response standard: acetone

Task 9. Instructions. Instead of a dash, enter only one word.

The process of oxidizing glucose in a cell to lactate is called _____glycolysis

Response standard: anaerobic.

Task 10. Instructions. Instead of a dash, enter only one word.

Lactate can be used in the process of gluconeogenesis for carbohydrate synthesis -_____.

Response standard: glucose.

Task 11.

Many drugs, having a structural similarity to the substrate on which the enzyme acts, slow down (or inhibit) the rate of the reaction with its participation.

Explain:

- A) What type of inhibition is observed under the action of drugs whose structure is similar to the structure of the substrate?
- B) Can the effect of the inhibitor be reduced by adding a substrate?

Response standard:

- A) Competitive inhibition.
- B) Yes. When adding substrate the influence of the inhibitor will decrease.

Task 12.

Isoenzymes: glucokinase and hexokinase catalyze the reaction transfer of a phosphoric acid residue from ATP to glucose. Glucokinase is localized primarily in the cells of the liver and pancreas, and hexokinase is localized in most organs and tissues. Explain the biological significance of the presence in the body enzyme data. For determine the answer: A) Which enzyme has a greater affinity for glucose if hexokinase has a lower value of the Michaelis constant (MC)?

B) Do liver or muscle cells require a higher concentration of glucose to carry out this reaction?

Response standard:

A) Hexokinase has a greater affinity for glucose than glucokinase.

B) In liver cells, the reaction occurs at a higher concentration of glucose.

Task 13.

During their digestion in the gastrointestinal tract, food proteins, fats, and carbohydrates are broken down into monomers, which are absorbed and can be broken down in the cells of the body into CO₂, H₂O and other low-molecular substances. Please indicate:

A) The name of the pathway in which all processes of catabolism of substances converge. B) Two stages of this path.

Response standard:

A) General path of catabolism.

B) Stages of the general pathway: decarboxylation of pyruvic acid (pyruvate), Krebs cycle (tricarboxylic acid cycle, TCA cycle).

Task 14.

Currently, a variety of nutritional supplements are actively used to improve performance, including Yantavit, a preparation of succinic acid (succinate). Why is this drug recommended to improve performance? To answer please indicate:

A) Succinate is an intermediate product of which cycle?

B) Which process further uses hydrogen atoms whose donor is succinate?

Response standard:

A) Succinate is an intermediate product of the Krebs cycle (TCC). B) During the process of oxidative phosphorylation.

Task 15.

Newborn babies have special fatty tissue in the neck and upper back area - the so-called "brown fat". A protein, thermogenin, is built into the mitochondrial membranes of "brown fat" cells, through which protons are transported. Why is the phosphorylation coefficient (P/O - the number of synthesized ATP molecules for each atom of absorbed oxygen) reduced in "brown fat" cells? To answer, please explain:

A) What processes does the thermogenin protein uncouple?

Q) What happens to the energy released during biological oxidation?

Response standard:

A) The processes of oxidation in the electron transport chain and phosphorylation of ADP (ATP synthesis) are separated.

B) The energy released during biological oxidation is dissipated as heat.

Task 16.

For supporting glucose level in the blood between doses food liver begins to produce rather than consume glucose. Please indicate:

A) Secretion of which hormone from the pancreas increases

at decrease in blood glucose concentration?

B) What processes of carbohydrate metabolism does it activate in the liver?

Response standard:

A) Glucagon.

B) Gluconeogenesis and glycogen

breakdown. Task 17.

During periods of intense physical work on muscles

accumulates lactic acid. Please indicate:

A) The name of the process in which lactate is formed.

B) The further fate of lactate.

Response standard:

A) Lactate is formed during anaerobic glycolysis.

B) Lactate is removed from skeletal muscles and enters the liver through the bloodstream, where, under the action of LDH1, which has a high affinity for lactate, it is converted into pyruvate and included in gluconeogenesis. And from the liver, newly synthesized glucose flows back into the muscles and is used as an energy substrate during work and to restore glycogen reserves during rest.

Task 18.

In the cell, glucose is converted into glucose-6-phosphate. This reaction is catalyzed in most tissues by the enzyme hexokinase ($K_M = 0.1 \text{ mmol/l}$, inhibited by excess glucose-6-phosphate), and in the liver and pancreas by glucokinase ($K_M = 10 \text{ mmol/l}$, not inhibited by glucose-6-phosphate). Explain:

A) Which of the following isoenzymes is more sensitive to glucose? B)

Compare where glycogen reserves are greater: in the liver and in the muscles?

Response standard:

A) Hexokinase is more sensitive to glucose. B)

The liver stores more glycogen.

Task 19.

The synthesis and breakdown of glycogen are reversible processes. Glycogen breakdown increases during fasting and under certain physiological conditions. It has been established that in muscles and in the liver, glycogen breaks down into different end products. Please indicate:

- A) End products of glycogen breakdown in the liver and muscles, respectively.
- B) Further use of the resulting glycogen end products in the liver and muscles.

Response standard:

- A) Glycogen in the liver breaks down into glucose, and in the muscles into glucose-6-phosphate.
- B) Glucose formed in the liver during the breakdown of glycogen leaves the cell and is used to maintain its level in the blood. Glucose-6-phosphate formed in the muscles is further broken down through the process of glycolysis and is used to produce energy.

Task 20.

Pancreatic TAG lipase, which hydrolyzes the terminal ester bonds, is involved in the digestion of triacylglycerides (TAG) in the duodenum. It is synthesized in the pancreas and secreted in an inactive form. Explain:

- A) When bound to which protein, pancreatic lipase is activated?
- B) What product of TAG hydrolysis is predominantly formed with the participation of pancreatic lipase?

Response standard:

- A) Pancreatic lipase is activated when it binds to a protein - colipase.
- B) The main product is monoacylglycerol (MAG).

Task 21.

Very low density lipoproteins (VLDL) are converted

Vlow lipoproteinsdensity

(LDL).

- A) Indicate where this process takes place?

B) Name the enzyme that is involved in the process of TAG hydrolysis in VLDL.

Response standard:

A) The conversion of VLDL into LDL occurs in the vascular bed (in the blood).

B) VLDL is converted into LDL with the participation of an enzyme
-lipoprotein lipases.

Task 22.

During fasting, ketone bodies are synthesized in liver cells. Explain: A) What compounds belong to this group of substances?

B) What is the main function of ketone bodies in the body?

Response standard:

A) Ketone bodies include: acetone, acetoacetate, β -hydroxybutyrate. B) Energy. Ketone bodies are used to synthesize ATP.

Task 23.

Ketone bodies are used for the body's energy needs in many physiological conditions: fasting, diabetes... Explain:

A) In the cells of which organ are ketone bodies synthesized?

B) From what compound are they synthesized?

Response standard:

A) Ketone bodies are synthesized in the liver. B)

They are synthesized from acetyl CoA (AcCoA)

Task 24.

With a defect in the enzymes of carnitine synthesis, its concentration in the cells of skeletal muscles and myocardium decreases. Such patients experience rapid fatigue and a sharp decrease in the ability to perform physical activity. Explain:

- A) What substances are transported from the cytosol to the mitochondria by carnitine?
- B) What process do transported substances undergo in mitochondria?

Response standard:

- A) Carnitine is involved in the transport of higher fatty acids (HFAs) from the cytosol to the mitochondria;
- B) In mitochondria, IVFA are broken down during the process of β -oxidation. Task 25.

Carnitine is involved in the transport of higher fatty acids (HFAs) from the cytosol to the mitochondria, where HFAs are broken down during β -oxidation. Explain: A) Why are IVHs not broken down in the cytosol of the cell?

- B) What product is formed during the breakdown of palmitic acid in the process of β -oxidation?

Response standard:

- A) Due to the absence of β -oxidation enzymes in cytosol,
which localized in mitochondria.
- B) Palmitic acid is broken down during the process of β -oxidation to
acetylCoA
(AcCoA).

Task 26.

At the first stage of digestion of food lipids, they are emulsified. Explain:

- A) What substances participate in this process? B) From what compound are they synthesized in the liver?

Response standard:

- A) Emulsification occurs with the participation of bile acids.
- B) From cholesterol.

Task 27.

The enzyme lipoprotein lipase catalyzes the reactions of complete hydrolysis of triacylglycerols (TAGs) in the composition of lipoproteins. It is known that the Michaelis constant (MC) of cardiac lipoprotein lipase is an order of magnitude smaller than the Michaelis constant (MC) of adipose lipoprotein lipase. Specify: A) Which of the TAG hydrolysis products is primarily used as an energy source? B) Do cardiac muscle or adipose tissue cells prefer to use this compound as an energy source?

Response standard:

- A) Higher fatty acids (HFAs).
- B) Mainly used by cardiac muscle cells.

Task 28. Instructions. Instead of a dash, enter only one word. High-density lipoproteins (HDL) carry out backtransport of cholesterol from cells of different organs and tissues into cells _____. Sample answer: liver

Task 29.

Cholesterol esters are formed from cholesterol with the participation of the corresponding acyltransferases (AT). Explain what substances serve as acyl group donors in:

- A) Blood?
- B) Cell?

Response standard:

- A) Lecithin (phosphatidylcholine) is a donor of acyl groups in the blood.
- B) AcylCoA is a donor of acyl groups in the cell.

Task 30.

Symptoms of steatorrhea, characterized by excess lipids in the stool, may be due to insufficient secretion of both pancreatic juice

glands and bile acids. Why do these reasons lead to the appearance of lipids in stool?

To answer please indicate:

A) A process in which bile acids take part.

B) The name of the pancreatic enzyme that takes part in the digestion of triacylglycerides.

Response standard:

A) Bile acids take part in the emulsification of lipids.

B) Digestion of emulsified lipids in the intestine occurs with the participation of pancreatic TAG lipase.

Task 31.

Glycerol, which is formed during hydrolysis of triacylglycerols (TAG), in adipose tissue is not used for TAG resynthesis. Explain:

A) The reason for the impossibility of TAG synthesis from glycerol in adipose tissue. B) In which glucose metabolic pathway is the substrate for TAG synthesis formed? Sample answer:

A) The enzyme glycerol kinase is inactive in adipose tissue.

B) In glycolysis.

Task 32.

Various methods are used to separate blood proteins. Explain:

A) What is the method of separating blood proteins called?

_____ based on _____ their different speeds of movement in an electric field?

B) What fractions can blood proteins be divided into using this method?

Response standard:

1) The method of separating blood proteins in an electric field is called _____ electrophoresis.

2) Blood proteins are divided into 5 fractions by electrophoresis: albumin, _____, _____, _____, _____-globulins.

Task 33.

To diagnose some diseases, the de Ritis coefficient (ratio of serum AST to ALT activity, coefficient = AST/ALT; reference interval=1.33±0.42). For what disease is it important? de Ritis coefficient:

- A) Decreasing?
- B) Is it increasing?

Sample answer:

A) The value of the de Ritis coefficient decreases in liver diseases. B) The value of the de Ritis coefficient increases with myocardial infarction.

Task 34.

Glutathione (GSH) is a tripeptide that is involved in neutralization of reactive oxygen species, oxidizing to GSSG.

- A) Is this process reversible?
- B) If yes, then indicate the enzyme with the participation of which the oxidized form of glutathione is restored.

Response standard:

- A) Yes.
- B) Glutathione reductase is involved in the reduction of the oxidized form to glutathione.

Task 35.

Food proteins in the stomach are hydrolyzed to high molecular weight polypeptides with the participation of the enzyme pepsin. Why do patients with hypoacid gastritis, in which the pH of gastric juice increases, have problems with the digestion of proteins in the stomach? To answer please indicate:

- A) The name of the compound that is involved in the activation of pepsinogen.
- B) Optimum pH for pepsin.

Response standard:

- A) Hydrochloric acid is a pepsinogen activator.
- B) Normally, the optimum pH for pepsin = 1.5-2.0 (2.5).

Task 36.

In the duodenum, protein digestion occurs with the participation of proteolytic enzymes secreted by the pancreas in an inactive form. Trypsinogen is initially activated by the intestinal enzyme enterokinase. Explain:

- A) What proteolytic enzymes secreted by the pancreas are subsequently activated by trypsin?
- B) Indicate how to activate them?

Response standard:

- A) Trypsin activates chymotrypsinogen, procarboxypeptidase, proelastase.
- B) Activation occurs through partial proteolysis.

Task 37.

High-density lipoproteins (HDL) act as cholesterol scavengers, which is why they are called anti-atherogenic. Please indicate:

- A) Site of HDL synthesis.
- B) With the participation of which enzyme in the composition of lipoproteins cholesterol esters are formed.

Response standard:

- A) HDL is synthesized in the liver.
- B) Lecithin: cholesterol acyltransferase (LCAT) catalyzes
reactionformation of cholesterol
esters from cholesterol.

Task 38.

Intracellular enzymes – aminotransferases, lysis
cellsenter the blood, where their level of activity
increases. Information about

The activities of individual aminotransferases in blood serum are used both in diagnosis and in assessing the severity of diseases. Please indicate:

A) Which aminotransferases are most often used

Venzyme diagnostics?

B) What diseases cause their activity to increase?

Response standard:

A) Activity of alanine aminotransferase (ALT) and aspartate aminotransferase (AST).

B) In case of myocardial infarction, the activity of AST predominantly increases, and in case of liver diseases - mainly ALT.

Task 39.

When amino acids are deaminated, ammonia is released, which is a toxic substance. The main route of its neutralization occurs in liver cells. Explain:

A) Predominantly in which amino acid is ammonia delivered from skeletal muscle cells to the liver?

B) What nitrogen-containing compound is synthesized from it in the liver and excreted by the kidneys?

Response standard:

A) In the form of alanine.

B) Urea.

Task 40.

Urea synthesis occurs in the liver and is necessary to neutralize toxic ammonia in the body. What is the toxic effect of ammonia on nervous system cells? To answer the question please explain:

A) The synthesis of which amino acids increases with an excess of ammonia from α -ketoglutarate.

B) The synthesis of which inhibitory neurotransmitter is disrupted by excess ammonia?

Response standard:

A) The synthesis of glutamic acid and glutamine increases. B) Synthesis decreases γ -aminobutyric acid.

Task 41.

The amino acid arginine is classified as a non-essential amino acids. Explain:

A) In which cycle is this amino acid formed?

B) What nitrogen-containing compound that causes vasodilation is formed from it?

Response standard:

A) Arginine is formed in the urea cycle. B)

Arginine produces nitric oxide (NO).

Task 42.

For patients suffering from diseases of the cardiovascular system treatment and prevention of myocardial damage, prescribe the drug

"Neoton", similar to endogenous creatine phosphate. Please indicate:

A) The name of the macroergic compound for synthesis whom creatine phosphate is used.

B) An enzyme that is involved in this reaction.

Response standard:

A) For the synthesis of ATP. B) Creatine kinase.

Task 43.

The main way of neutralizing ammonia is its binding

Vornithine cycle with the

formation of urea. Explain:

A) In the cells of which organ does urea synthesis occur? B)

Which cycle is the ornithine cycle associated with?

Response standard:

A) Urea synthesis occurs in liver cells.

B) The ornithine cycle is related to the Krebs cycle (tricarboxylic acid cycle).

Task 44.

Glutathione (GISH) is a tripeptide with antioxidant properties. It participates in the neutralization of reactive oxygen species, oxidizing to GISSG1. Please indicate:

A) One of the reactive oxygen species that is involved in the oxidation of glutathione.

B) An enzyme that speeds up this reaction.

Response standard:

A) Hydrogen peroxide (H₂O₂) - oxidizes glutathione.

B) The reaction occurs with the participation of the enzyme glutathione peroxidase.

Task 45.

A deficiency of one of the fat-soluble vitamins may result in impaired twilight vision. Explain:

A) what fat-soluble vitamin is involved? B) Which protein is this vitamin attached to?

Response standard:

A) Vitamin A (retinal) is responsible for the formation of twilight vision. B) To the opsin.

Task 46.

Hemoglobin is a protein that takes part in the transport of oxygen from the lungs to the tissues and CO₂ from the tissues to the lungs.

- A) Name the non-protein part of hemoglobin.
- B) Indicate the number of subunits of which it consists.

Response standard:

- A) Heme is the non-protein part of hemoglobin.
- B) Hemoglobin consists of four subunits of two types, which determine the type of hemoglobin.

Task 47.

Hemoglobin is easily oxidized by reactive oxygen species

And turns into

methemoglobin. Explain:

- A) What is the oxidation state of iron in methemoglobin? B) Is methemoglobin capable of transporting oxygen?

Response standard:

- A) Iron is in oxidation state = +3.
- B) Methemoglobin is not capable of transporting oxygen.

Task 48.

The binding of hemoglobin to oxygen is a regulated process. Explain: A) How does the affinity of hemoglobin for oxygen change with decreasing pH?

- B) Give an example of a compound that reduces the affinity of hemoglobin for oxygen.

Response standard:

- A) As the pH decreases, the affinity of hemoglobin for oxygen decreases.
- B) 2,3-diphosphoglycerate reduces the affinity of hemoglobin for oxygen.

Task 49.

Heme, which is part of hemoglobin, contains a porphyrin ring and metal ions.

Please indicate:

- A) Which metal ions are included in the composition of heme. B) The oxidation state of the metal.

Response standard:

A) Each heme contains one iron ion. B) Oxidation state of iron ions = +2.

Task 50.

When stove heating is used incorrectly, people often suffer from carbon monoxide (CO) poisoning. Explain what disorders are observed with carbon monoxide poisoning? To answer, indicate the effect of carbon monoxide on:

- A) The ability of hemoglobin to carry oxygen.
- B) The rate of electron transport along the electron transport chain (ETC)?

Response standard:

- A) Decreases because carboxyhemoglobin is formed, which is not capable of binding O₂.
- B) Stops because CO inhibits complex IV of the respiratory chain (cytochrome oxidase).

Task 51.

Myoglobin—one of the main proteins of muscle tissue. It is like hemoglobin, binds oxygen, but has certain differences. Explain: A) How many polypeptide chains does myoglobin consist of?

- B) Compare affinity to oxygen of myoglobin and hemoglobin.

Response standard:

- A) Myoglobin consists of one polypeptide chain. B) Myoglobin has a greater affinity for oxygen.

Task 52.

For the treatment and prevention of cardiovascular diseases, patients are prescribed drugs that are analogues of endogenous creatine phosphate, which is involved in the synthesis of ATP. Please indicate:

- A) The name of the enzyme that catalyzes this reaction.
- B) The number of its isoenzymes and their preferential localization.

Response standard:

- A) Creatine kinase (or creatine phosphokinase).
- B) Creatine kinase has three isoforms: MM - predominant in skeletal muscles, BB - in the brain, MB - in the heart.

Task 53.

Nervous tissue is characterized by a high intensity of energy metabolism. At the same time, the brain does not use fatty acids as a substrate for energy. Explain:

- A) Why does the brain not use fatty acids as an energy substrate?
- B) Which compound is primarily used by the brain to produce energy during the absorptive period?

Response standard:

- A) IVHs do not cross the blood-brain barrier.
- B) Glucose is used as the main energy source for energy production during the absorptive period.

Task 54.

The binding of hemoglobin to oxygen is a regulated process. With intense muscle activity, body temperature rises. How does it change with increasing temperature:

- A) What is the affinity of hemoglobin for oxygen?
- B) Supplying intensely working muscles with oxygen?

Response standard:

- A) Hemoglobin affinity for oxygen increases
temperature decreases.
- B) Intensely working muscles receive more oxygen.

Task 55.

Residents of high mountain areas often have elevated levels of 2,3-diphosphoglycerate in the blood. Explain what effect this compound has on:

- A) What is the affinity of hemoglobin for oxygen?
- B) Transport of oxygen from erythrocytes to cells?

Response standard:

- A) 2,3-diphosphoglycerate reduces the affinity of hemoglobin for oxygen.
- B) The flow of oxygen from red blood cells into cells accelerates.

Task 56.

When heme breaks down in RPE cells, bilirubin is formed, which is then transported in the form of a complex with protein. Explain:

- A) In combination with which protein is bilirubin transported? B)

What is the name of the resulting form of bilirubin?

Response standard:

- A) Bilirubin is transported in combination with albumin.
- B) The complex of bilirubin with albumin is called indirect bilirubin.

Task 57.

In liver cells, bilirubin (a breakdown product of heme) reacts with UDP-Glucuronic acid (UDP-GA) to form a more soluble form - bilirubin glucuronide (bilirubin-GA). Please enter a name:

- A) This reaction.
- B) The resulting form of bilirubin?

Response standard:

- A) Conjugation reaction.
- B) Direct bilirubin.

Task 58.

In RPE cells, hemoglobin breaks down. Its non-protein part, heme, undergoes further decay. Explain:

A) What product is formed during the complete breakdown of heme? B) In what forms is it found in the blood?

Response standard:

A) Bilirubin is formed during the complete breakdown of heme. B) In the form of direct and indirect bilirubin.

Task 59.

Residents of high mountain areas often have elevated levels of 2,3-diphosphoglycerate. Explain:

A) How does this compound affect the binding of hemoglobin to oxygen? B) In what process is its precursor, 1,3 diphosphoglycerate, formed? Sample answer:

A) 2,3-diphosphoglycerate reduces the affinity of hemoglobin for oxygen and facilitates its entry from red blood cells into cells.

B) 1,3-diphosphoglycerate is formed during glycolysis.

Task 60.

Glucose enters cells with the participation of carrier proteins (GluT) different types. Some transporter proteins are built into cytosolic

cell membranes, and the other is stored in the form of vesicles in the cytosol. Explain: A) In the cells of which tissues are transporters located in the cytosol?

B) With the participation of what hormone are these transporters integrated into membranes?

Response standard:

A) In the cytosol of adipose tissue and skeletal muscle cells.

B) With the participation of insulin.

Task 61.

The carrier protein GluT-4 is involved in the transport of glucose in the cells of adipose tissue and skeletal muscles. How is the transport of glucose into the cells of these tissues related to the level of insulin in the blood? To answer, please explain:

- A) The role of insulin in the transport of glucose into the cells of these tissues.
- B) How does the blood glucose level change when insulin concentration decreases?

Response standard:

- A) When insulin interacts with membrane receptors, GLUT-4 moves from the cytoplasm to the cell membrane and transport of glucose from the blood into the cell is ensured.
- B) Blood glucose levels increase. When the insulin concentration decreases, the transporters are not integrated into the membrane, and glucose does not enter the cells of these tissues.

Task 62.

An increased content of uric acid was detected in the patient's 24-hour urine and blood serum. The doctor prescribed the patient a medication, allopurinol, and recommended a diet with limited consumption of meat products. Explain:

- A) The breakdown product of which compounds is uric acid?
- B) What type of reversible inhibition is the action of allopurinol based on?

Response standard:

- A) Purine bases (nucleotides).
- B) On competitive inhibition. Allopurinol is a structural analogue of hypoxanthine and a competitive inhibitor of the enzyme xanthine oxidase.

Task 63.

When examining a 3-year-old girl with progressive mental retardation, an increased content of phenylpyruvate was found in the urine. Please indicate:

- A) What amino acid is phenylpyruvate synthesized from?
- B) The name of the enzyme, the decrease in activity of which leads to the accumulation of phenylpyruvate?

Response standard:

- A) From phenylalanine.
- B) The enzyme phenylalanine hydroxylase. When its activity decreases, phenylalanine is not oxidized to tyrosine, but undergoes a transamination reaction to form phenylpyruvate, which is excreted in the urine.

Task 64.

One of the clinical symptoms of insulin-dependent diabetes mellitus is hyperglycemia. Why does the blood glucose level increase when insulin secretion decreases? To answer, explain the effect of insufficient insulin secretion:

- A) For the transport of glucose into the cells of adipose tissue and skeletal muscles.
- B) Processes of gluconeogenesis and glycogen metabolism in the liver.

Response standard:

- A) Insulin enhances the transport of glucose into cells.
- B) Gluconeogenesis and glycogen breakdown increase in the liver.

Task 65.

One of the clinical symptoms of insulin-dependent diabetes mellitus is ketonemia. Why does the level of ketone bodies in the blood increase when insulin secretion decreases? To answer please indicate:

- A) in what process of VFA exchange are substrates formed for the synthesis of ketone bodies?
- B) how does insulin deficiency affect this process?

Response standard:

- A) In the process of β -oxidation of IVFA.

B) β -oxidation of IVFA is enhanced.

Task 66.

One of the clinical symptoms of insulin-dependent diabetes mellitus is azotemia. Why does nitrogen excretion from the body increase when insulin secretion decreases? To answer, indicate the effect of insulin deficiency on metabolism:

- A) Endogenous proteins.
- B) Amino acids.

Response standard:

A) The breakdown of endogenous proteins increases. B) The breakdown of amino acids increases.

Task 67.

According to the doctor's recommendations, the patient limited himself in the consumption of food of animal origin and significantly increased the consumption of plant foods. How will the acidity of urine change? To answer the question please indicate:

- A) The acidity (weakly acidic, neutral, slightly alkaline) of urine is normal.
- B) Acidity of urine when eating food predominantly of plant origin.

Response standard:

A) Normal urine acidity is slightly acidic.
B) The acidity of urine when eating food predominantly of plant origin is slightly alkaline.

Task 68.

A large number of metabolites are dissolved in the cytoplasm of myocytes
oxidation of glucose, one
of which is converted to lactate. Please indicate:

- A) Which metabolite of glucose is converted into lactate.
- b) With the participation of which enzyme and coenzyme does this reaction occur?

Response standard:

A) Pyruvate.

B) The reaction occurs with the participation of the enzyme lactate dehydrogenase, the coenzyme of which is NADH.

Task 69.

A group of drugs that lower the concentration of cholesterol in the blood include statins. Explain:

A) Which enzyme activity do they inhibit? B) What type of inhibitors are they?

Response standard:

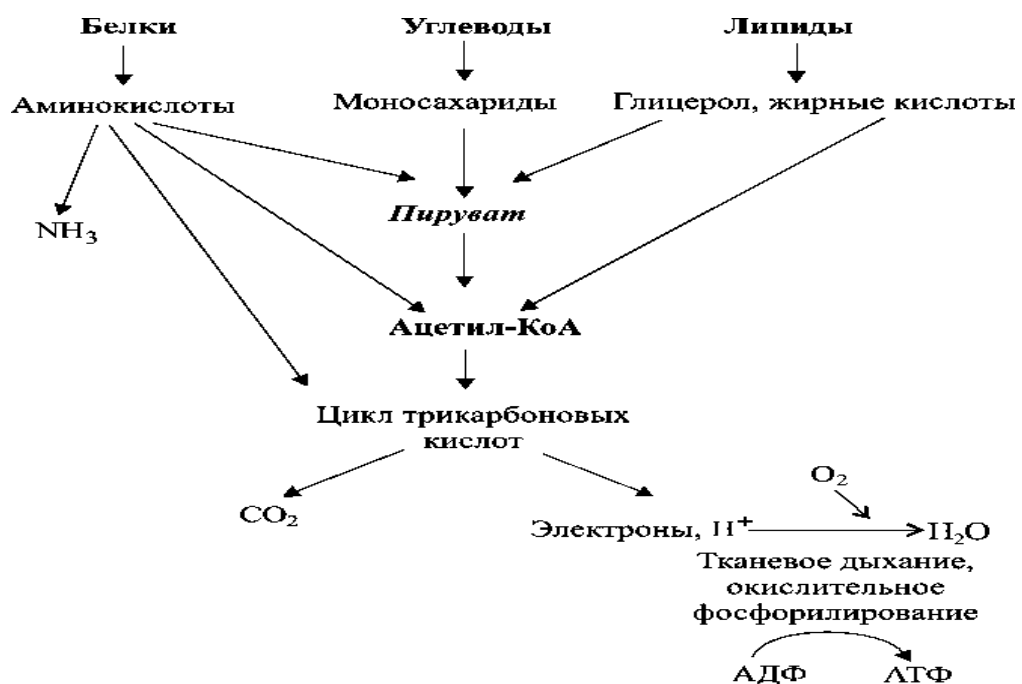
A) They change the activity of the enzyme - hydroxymethylglutaryl CoA reductase (HMG CoA reductase).

B) To competitive inhibitors.

Task 70. Interview question.

Write a general diagram of the catabolism of substances and energy in the body.

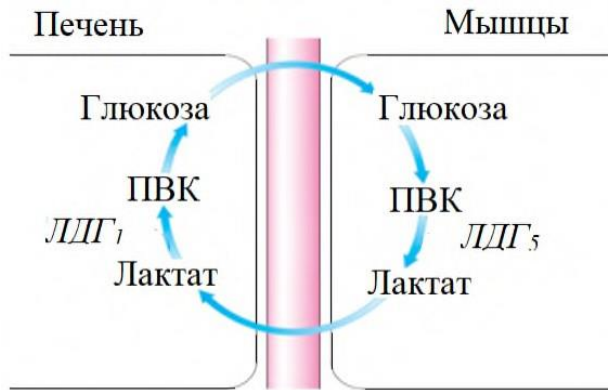
Response standard:



Task 71. Interview question.

Write a diagram of the Cori cycle.

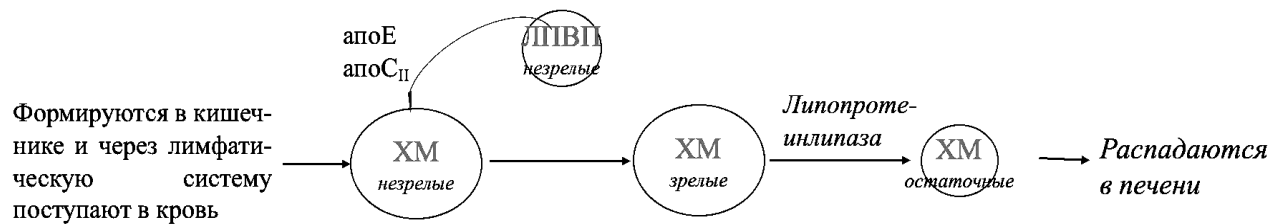
Response standard:



Task 72. Interview question.

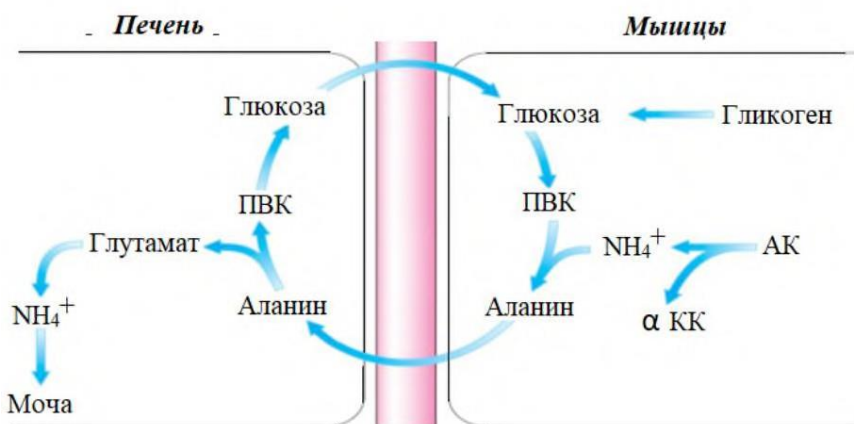
Write a diagram of the exchange of chylomicrons (CM) in the body.

Response standard:



Task 73. Interview question. Write the alanine-glucose diagram.

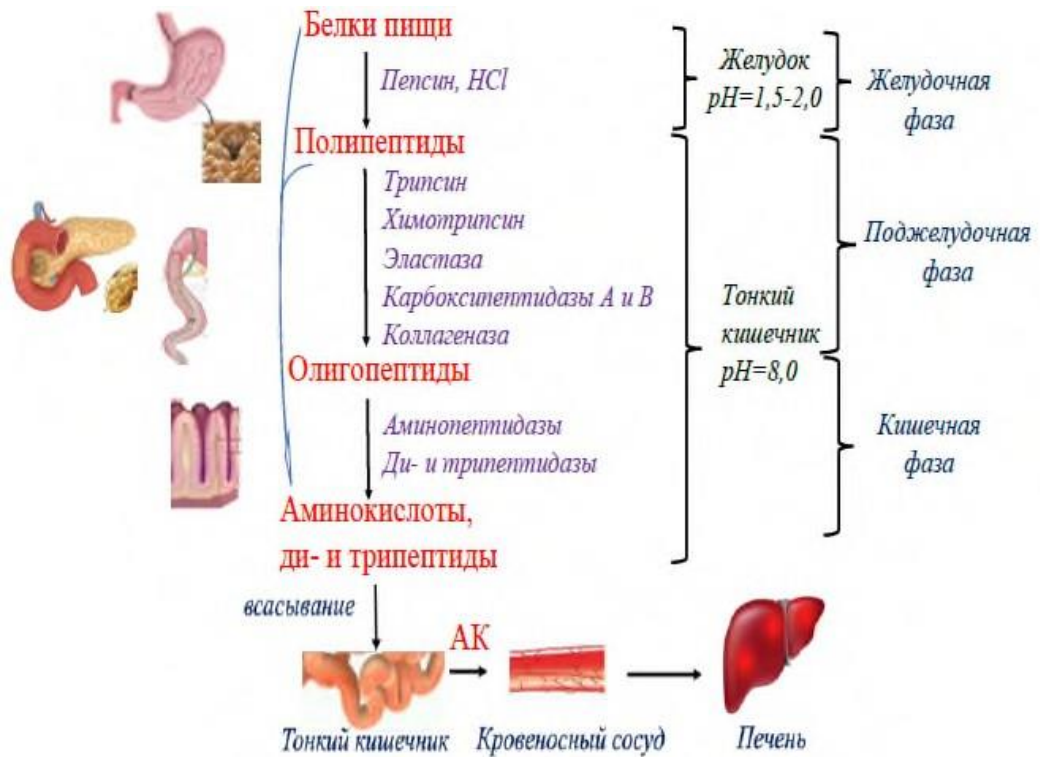
Response standard:



Task 74. Interview question.

Write a diagram of protein digestion in the gastrointestinal tract

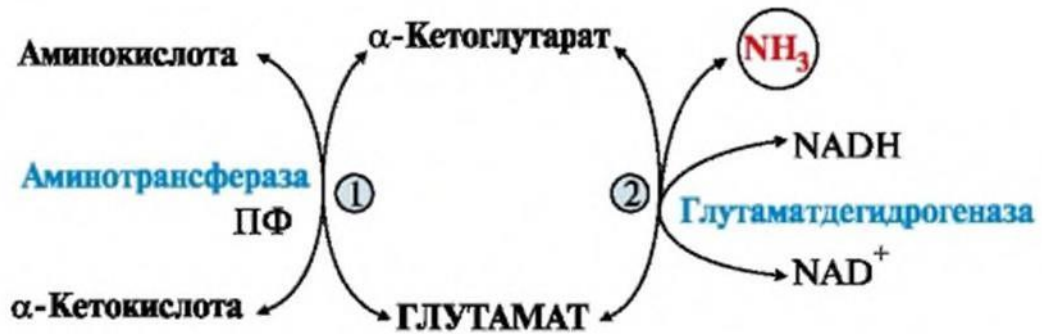
Response standard:



Task 75. Interview question.

Write a scheme for indirect deamination of amino acids

Response standard:



CRITERIA for assessing competencies and rating scales

Grade "unsatisfactory"(not accepted) or lack of competence	Grade "satisfactorily"(passed) or satisfactory (threshold) level of competence development	Rating "good" (passed) or a sufficient level of mastery of competence	"Excellent" (passed) or high level of competency development
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The student's inability to independently demonstrate knowledge when solving tasks, lack of independence in applying skills. The lack of confirmation of the development of competence indicates negative results in mastering the academic discipline.	The student demonstrates independence in applying knowledge, skills and abilities to solve educational tasks in full accordance with the model given by the teacher; for tasks the solution of which was demonstrated by the teacher, it should be considered that the competence is formed at a satisfactory level.	The student demonstrates independent application of knowledge, skills and abilities when solving tasks similar to the samples, which confirms the presence of developed competence at a higher level. The presence of such competence at a sufficient level indicates a firmly established practical skill	The student demonstrates the ability to be completely independent in choosing a way to solve non-standard tasks within the discipline using knowledge, skills and abilities acquired both in the course of mastering this discipline and related disciplines; competence should be considered developed at a high level.
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Criteria for assessing test control:

percentage of correct answers	Marks
91-100	Great
81-90	Fine
70-80	satisfactorily
Less than 70	unsatisfactory

When grading tasks with multiple correct answers, one error is allowed.

Interview assessment criteria:

Mark	Descriptors		
	strength of knowledge	ability to explain (present) the essence of phenomena, processes, draw conclusions	logic and consistency answer
Great	strength of knowledge, knowledge of the basic processes of the subject area being studied, the answer is distinguished by the depth and completeness of the topic; mastery of terminology; logic and consistency answer	high ability to explain the essence, phenomena, processes, events, draw conclusions and generalizations, give reasoned answers, give examples	high logic and consistency of the answer

Fine	strong knowledge of the basic processes of the subject area being studied, distinguished by the depth and completeness of the topic; mastery of terminology; fluency in monologue speech, but one or two inaccuracies are allowed answer	the ability to explain the essence of phenomena, processes, events, draw conclusions and generalizations, give reasoned answers, give examples; however, one or two inaccuracies in the answer are allowed	logic and consistency of the answer
satisfactory	satisfactory knowledge of the processes of the subject area being studied, an answer characterized by insufficient depth and completeness of the topic; knowledge of the basic issues of theory. Several are allowed errors in the content of the answer	satisfactory ability to give reasoned answers and give examples; satisfactorily developed skills in analyzing phenomena and processes. There may be some errors in the content. answer	satisfactory logic and consistency of the answer
unsatisfactory	poor knowledge of the subject area being studied, shallow coverage of the topic; poor knowledge of basic theoretical issues, poor skills in analyzing phenomena and processes. Serious errors in the content of the answer are allowed	inability to give reasoned answers	lack of logic and consistency in the answer

Criteria for assessing situational tasks:

Mark	Descriptors			
	understand ing the problem	analysis of the situation	skills solutions to the situation	professional thinking
Great	full understanding of the problem. All requirements for the task have been met	high ability to analyze a situation and draw conclusions	high ability to choose a method to solve a problem, confident solution skills situations	high level of professional thinking
Fine	full understanding of the problem. All requirements required for	ability to analyze a situation and draw conclusions	ability to choose a method to solve a problem confident	sufficient level of professional thinking. One or two inaccuracies in the answer are allowed

	task completed		situation solving skills	
satisfactory	partial understanding of the problem. Most of the job requirements completed	satisfactory ability to analyze a situation and draw conclusions	satisfactory skills in solving a situation, difficulties in choosing a method for solving a problem	sufficient level of professional thinking. More than two inaccuracies in the answer or an error in the sequence are allowed solutions
unsatisfactory	misunderstanding of the problem. Many requirements for the assignment have not been met. No answer. There was no attempt to solve task	low ability to analyze the situation	insufficient situation-solving skills	absent