

ЛД-21 ИИ

Federal State Budgetary Educational Institution of Higher Education  
«North-Ossetia State Medical Academy»  
of the Ministry of Healthcare of the Russian Federation

Department of biological chemistry

**METHODOLOGICAL INSTRUCTIONS FOR PERFORMANCE OF INDEPENDENT  
(OUT-OF-AUDIT) WORK**




**on clinical laboratory diagnostics**

to the main professional educational program of higher education - specialty program in the  
specialty 31.05.01 General Medicine, approved in May 24, 2023

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Methodical recommendations are intended for extracurricular independent work of 6th year students (12 semester) of the Faculty of General Medicine  
FSBEI HE NOSMA MOH of the Ministry of Healthcare of the Russian Federation  
in the discipline "**Clinical laboratory diagnostics**"

**Developers:**

Head of the department  A.E. Gurina  
Associate professor of the department  A.B. Plieva  
Assistant of the department  Z.A. Khetagurova

**Reviewers:**

Bolieva L.Z., head of the department, of Pharmacology with Clinical pharmacology FSBEI HE NOSMA MOH Russia, doctor of medical sciences, professor.

Ovsiannikova A.I., head of the clinical diagnostic laboratory of LLC "Clinical diagnostic laboratory  
Dzagurov G.K., candidate of medical sciences

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Fundamentals of the organization of health care and laboratory services"**

**Lesson number 1**

**Initial level of knowledge:**

- The laboratory service and its place in the health care system.
- Normative documents governing the activities of the laboratory service.
- Fundamentals of medical ethics and deontology.

<p><b>The student should know:</b></p> <ul style="list-style-type: none"><li>• Normative documents regulating the activities of the laboratory service</li><li>• Types of internal laboratory quality control</li><li>• Principles of internal laboratory quality control</li><li>• Reporting forms of internal laboratory quality control</li><li>• Westgard rules</li></ul> <p><b>The student should be able to:</b></p> <ul style="list-style-type: none"><li>• Use the regulations governing the activities of the laboratory service</li><li>• Build calibration graphs</li><li>• Evaluate calibration plots</li><li>• Put into practice the rules of Westgard</li></ul>	<p><b>Main literature:</b></p> <ol style="list-style-type: none"><li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T2.</li><li>2. Hematological analyzers. Interpretation of a blood test. Guidelines. S. A. Lugovskaya, M. E. Postman, V.V. Dolgov. M., 2008, 28s.</li><li>3. Handbook of clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T1.107s.</li><li>4. Order No. 380 of 12/25/1997 "On the state and measures to improve laboratory support for diagnosis and treatment of patients in healthcare institutions of the Russian Federation"</li></ol> <p><b>Additional literature:</b></p> <p>Orders of the Ministry of Health No. 545, No. 220, No. 45, No. 290, No. 408, No. 386</p>
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**Self-study assignments**

**Add definitions:**

1. 1. Clinical laboratory diagnostics is \_\_\_\_\_

2. Clinical laboratory diagnostics includes \_\_\_\_\_

3. Improving the quality of laboratory research is carried out by \_\_\_\_\_

#### 4. What are the main tasks of the CDL

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#### 5. KDL carries out:

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#### Test tasks:

1. *The following non-laboratory factors may affect the analysis results:*

- A) Physical and emotional stress of the patient
- B) Circadian rhythms, climate influence
- C) Body position
- D) Taking medications
- E) All of the above

2. *The accompanying form for the material entering the laboratory must indicate the following, in addition to:*

- A) Full name of the patient (No. of medical history)
- B) Type of research
- C) Presumptive diagnosis
- D) Last name of the attending physician
- E) Research method

3. *The main tasks of the clinical diagnostic laboratory are:*

- A) Providing clinical laboratory research in accordance with the profile of the healthcare facility
- B) Introduction of progressive forms of work, new methods
- C) Providing advice to doctors of medical departments in the interpretation of laboratory data
- D) Advanced training of laboratory personnel
- E) Carrying out measures for labor protection of personnel, compliance with safety measures
- E) All of the above is true

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Fundamentals of the organization of health care and laboratory services"**

**Lesson number 2**

**Initial level of knowledge:**

- Types of internal laboratory quality control.
  - Principles of internal laboratory quality control.
  - External quality control.

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"> <li>— • Normative documents regulating the activities of the laboratory service</li> <li>• Types of internal laboratory quality control</li> <li>• Principles of internal laboratory quality control</li> <li>• Reporting forms of internal laboratory quality control</li> <li>• Westgard rules</li> </ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"> <li>• Use the regulations governing the activities of the laboratory service</li> <li>• Build calibration graphs</li> <li>• Evaluate calibration plots</li> <li>• Put into practice the rules of Westgard</li> </ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"> <li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T2.</li> <li>2. Hematological analyzers. Interpretation of a blood test. Guidelines. S. A. Lugovskaya, M. E. Postman, V.V. Dolgov. M., 2008, 28s.</li> <li>3. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T1.107s.</li> <li>4. Order No. 380 of 12/25/1997 "On the state and measures to improve laboratory support for diagnosis and treatment of patients in healthcare institutions of the Russian Federation"</li> </ol> <p><b><u>Additional literature:</u></b></p> <p>Orders of the Ministry of Health No. 545, No. 220, No. 45, No. 9.</p>

**Self-study assignments**

**Add definitions:**

1. Improving the quality of laboratory research is carried out by \_\_\_\_\_

2. In what directions is the quality control of laboratory research carried out \_\_\_\_\_

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3. What allows you to identify an external assessment of the quality of laboratory research

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4. Internal laboratory quality control is \_\_\_\_\_

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**Test tasks:**

1. *External quality control is*

A) *Metrological control*

B) *Control of the use of research methods by different laboratories*

C) *The system of measures designed to evaluate the method*

D) *The system of objective verification of the results of laboratory studies of different laboratories*

E) *All of the above is true*

2. *Internal laboratory quality control is*

A) *Identification and elimination of unacceptable analytical errors.*

B) *Assessment of the convergence of measurement results.*

C) *Evaluation of reproducibility and accuracy of measurement results, construction of control charts.*

D) *Conducting operational quality control of laboratory research results in each analytical series.*

E) *All of the above is true*

**Methodical recommendations for performing extracurricular independent work  
for a lesson on the topic: "HEMATOLOGY"**

**Lesson number 1**

**Initial level of knowledge:**

- The concept of hematopoiesis
  - Periods of formation of hematopoiesis
  - Morphology and function of blood cells
  - General blood analysis
  - Leukocyte formula

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"> <li>• Hematopoiesis scheme           <ul style="list-style-type: none"> <li>• Critical periods of the formation of hematopoiesis</li> <li>• Morphology and function of blood cells</li> <li>• General blood analysis</li> <li>• Anemia</li> <li>• Leukocyte formula</li> <li>• Leukemia</li> </ul> </li> </ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"> <li>• Interpret a complete blood count</li> <li>• Interpret the leukocyte formula</li> </ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"> <li>1. 1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T2.</li> <li>2. Hematological analyzers. Interpretation of a blood test. Guidelines. S. A. Lugovskaya, M. E. Postman, V.V. Dolgov. M., 2008, 28s.</li> <li>3. Blood. Clinical analysis. Diagnosis of anemia and leukemia. Interpretation of results. G.I. Kozinets, V.M. Pogorelov, O.A. Diaghileva, I.N. Naumova. M.2006. p. 251.</li> <li>4. Laboratory hematology S. A. Lugovskaya, V. T. Morozova, M. E. Postman, V.V. Dolgov, M. 2006. With. 7-82.</li> </ol> <p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"> <li>1. 1. Research of the blood system in clinical practice. Edited by G.I. Kozintsa, V.A. Makarov. M. Triad-X, 1997.</li> </ol>
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**Self-study assignments**

**Add definitions:**

**1.Bleeding (hematopoiesis)**

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**2.Erythroblast -** \_\_\_\_\_

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**3.Pronormoblast -** \_\_\_\_\_

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**4.Normoblast basophilic -** \_\_\_\_\_

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5.Erythrocyte \_\_\_\_\_

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6.Normoblast oxyphilic \_\_\_\_\_

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7.Reticulocyte \_\_\_\_\_

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8.Normoblast polychromatophilic \_\_\_\_\_

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9.Myeloblast \_\_\_\_\_

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10. Complete blood count includes:

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11.Classification of anemias

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12.Normal Leukocyte Formula

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**Test tasks:**

1. *Sources of errors in determining ESR can be:*
  - A. Incorrect ratio between sodium citrate and blood
  - B. Clot formation
  - C. Oblique capillary position
  - D. Non-compliance with temperature conditions
  - E. All of the above
2. *An increase in the number of reticulocytes occurs when:*
  - A. Aplastic anemia
  - B. B-12 deficiency anemia
  - C. Hemolytic syndromes
  - D. Cancer metastases in the bone marrow
  - E. Anemia in chronic diseases
3. *The values of the average erythrocyte volume (MCV) and color index are increased at:*
  - A. Iron deficiency anemia
  - B. Anemias in chronic diseases
  - C. Megaloblastic anemias
  - D. Thalassemias
  - E. Hemoglobinopathies
4. *The hemoglobin molecule consists of:*
  - A. Protoporphyrin and iron
  - B. Porphyrin and iron
  - C. Heme and globin
  - D. Globin and iron
  - E. Protoporphyrin and globin



5. *Neutropenia is typical for all situations except:*

- A. Aplastic anemia
- B. B-12 deficiency anemia
- C. Treatment with cytostatics
- D. Viral infections
- E. Acute inflammation

6. *Hemogram in acute leukemia is not typical:*

- A. thrombocytosis
- B. Leukocytosis
- C. Neutropenia
- D. Blastemia
- E. Anemia

**Methodological recommendations for performing extracurricular independent work for a lesson on the topic: "CLINICAL STUDIES"**

**Lesson number 1**

**Initial level of knowledge:**

- General urine analysis, physical and chemical properties of urine, microscopic examination of urine sediment;
  - Urinary syndrome in various diseases (urethritis, prostatitis, cystitis, kidney stones, acute renal failure, chronic renal failure);
  - Acute renal failure (ARF);
  - Chronic renal failure (CRF).
  - Urine analysis according to Nechiporenko;
  - Study of urine according to Zimnitsky.

**The student should know:**

- Physical properties of urine
  - Chemical examination of urine
  - Microscopic examination of urine sediment
    - What form elements increase in urine with pyelonephritis?
    - How many cylinders are normal for urine analysis according to Nechiporenko?
    - What corpuscles increase in urine with glomerulonephritis?
    - What is nephrotic syndrome?
    - Study of urine according to Zimnitsky.

**The student should be able to:**

- Determine the physical properties of urine
  - Work with diagnostic test strips
  - Conduct microscopic examination of urine

**Main literature:**

1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T2.
2. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T 1.107s.
3. Clinical laboratory diagnostics. Reference book for doctors. St. Petersburg. 1997. S. 60-125.
4. Laboratory diagnostics of kidney diseases with the basics of pathophysiology. A guide for doctors. I.A. Volkova. M. 2012.S. 3-73.

**Additional literature:**

1. Laboratory research methods. V.E. Predtechensky, V.M. Borovskaya, L.T. Margolina. M. 1950.S. 253-398.

## Self-study assignments

### Add definitions:

Physical properties of urine include the definition of \_\_\_\_\_

\_\_\_\_\_

Chemical examination of urine includes the definition of \_\_\_\_\_

\_\_\_\_\_

The main compounds that form crystals in urine are:

\_\_\_\_\_

In the organized sediment of urine, cells are distinguished \_\_\_\_\_

\_\_\_\_\_

Kidney stone disease - \_\_\_\_\_

\_\_\_\_\_

Arrester types: \_\_\_\_\_

\_\_\_\_\_

Reasons for chronic renal failure:

\_\_\_\_\_

Urine analysis according to Nechiporenko includes:

\_\_\_\_\_

\_\_\_\_\_

What kidney function can be assessed by the Zimnitsky test \_\_\_\_\_

\_\_\_\_\_

When is nephrotic syndrome diagnosed:

\_\_\_\_\_

\_\_\_\_\_

### Test tasks:

1. Determination of the relative density of urine gives an idea of:

A. Excretory function of the kidneys

B. Concentration function

B. Filtration function

D. All of the above functions

2. The relative density of urine significantly increases:

A. Red blood cells

B. Leukocytes

B. Glucose

G. Salt

3. Normal protein content in urine:

A. 0.033-0.1 g / l

B. Above 0.5g / L

B. 0.2-0.3 g / l

G. 0.3-0.5 g / l

- E. Completely missing*
- 4. Screening test for latent bacteriuria:*
  - A. Definition of urates*
  - B. Determination of leukocytes*
  - B. Determination of bile acids*
  - D. Determination of nitrite*
- 5. An increase in the level of ketone bodies is observed when:*
  - A. Diabetic ketoacidosis*
  - B. Prolonged fasting*
  - B. Severe restriction of carbohydrates in the diet*
  - D. Intoxication*
  - E. All of the above is true*
- 6. The relative density of urine is normally higher:*
  - And in the evening*
  - B. In the afternoon*
  - B. At night*
  - G. In the morning*
- 7. For urine analysis according to Nechiporenko use:*
  - A. Whole portion of urine*
  - B. Midstream urine*
  - B. Daily urine portion*
  - D. Morning midstream urine*

**Methodological recommendations for performing extracurricular independent work for a lesson  
on the topic: "CLINICAL STUDIES"**

**Lesson number 2**

**Initial level of knowledge:**

- Methods of obtaining and examination of gastric contents.
- Methods of obtaining and research of duodenal contents.

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"><li>• Methods for obtaining gastric contents</li><li>• Methods for obtaining duodenal contents</li><li>• Physicochemical properties of duodenal contents</li><li>• Physicochemical properties of bile</li><li>• Microscopic examination of duodenal contents</li></ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"><li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T2.</li><li>2. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T1.1</li><li>3. Clinical laboratory diagnostics. Reference book for doctors. St. Petersburg. 1997. S.91-106.</li></ol>
<p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"><li>• Determine the physical properties of the duodenal contents.</li><li>• Determine the chemical properties of the duodenal contents.</li><li>• Conduct a macroscopic examination of the duodenal contents.</li></ul>	<p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"><li>1. Laboratory research methods. V.E. Predtechensky, V.M. Borovskaya, L.T. Margolina. M. 1950. S. 253-398.</li></ol>

**Self-study assignments**

**Add definitions:**

Physical properties of gastric contents include determination

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Physical properties of duodenal contents  
include defining

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Chemical examination of gastric contents includes the definition

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Chemical research of duodenal contents includes the definition

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To diagnose which diseases are used microscopic examination of the duodenal contents:

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What is the diagnosis of achilia? \_\_\_\_\_

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**Test tasks:**

- I. 1. The composition of gastric juice includes:
- A. Hydrochloric acid
  - B. Digestive enzymes
  - C. Mucus
  - D. All answers are correct
  - E. There is no correct answer
2. Enzymes of gastric juice include
- A. Trypsin
  - B. Pepsin
  - C. Alpha-amylase
  - D. All answers are correct
  - E. There is no correct answer
3. Hydrochloric acid is secreted:
- A. The lining (parietal) cells of the fundic glands of the stomach
  - B. Main cells
  - C. Accessory cells
  - D. All answers are correct
  - E. There is no correct answer
4. The green color of bile in portion B is due to:
- A. Inflammation of the gallbladder and oxidation of bilirubin to biliverdin
  - B. Hemolytic jaundice
  - B. Cirrhosis of the liver
  - D. Iron deficiency anemia

**Methodological recommendations for performing extracurricular independent work for a lesson  
on the topic: "CLINICAL STUDIES"**

**Lesson number 3**

**Initial level of knowledge:**

- Methods for obtaining cerebrospinal fluid. Physicochemical characteristics.
  - The concept of cytolysis, pleocytosis.
  - Microscopic examination.
  - Counting of leukocytes in the Fuchs-Rosenthal chamber.

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"><li>• Physicochemical properties of cerebrospinal fluid<ul style="list-style-type: none"><li>• Microscopic examination of cerebrospinal fluid</li></ul></li></ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"><li>• Determine the physical and chemical properties of the cerebrospinal fluid<ul style="list-style-type: none"><li>• Work with the Fuchs-Rosenthal camera</li><li>• Be able to count leukocytes in the Fuchs-Rosenthal chamber</li><li>• Conduct microscopic examination of cerebrospinal fluid</li></ul></li></ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"><li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. Moscow, 1999, T</li><li>2. Clinical laboratory diagnostics. Reference book for doctors. St. Petersburg. 1997. S. 120-125.</li><li>3. Laboratory examination of cerebrospinal fluid. S.G. Mardanly, Yu.V. Pervushin, N.I. Kovalevich, V.N. Ivanova. Toolkit. Elektrogorsk. 2007.</li></ol> <p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"><li>1. Titz N. Clinical guidelines for laboratory tests. Per. from English Ed. V.V. Menshikov; M., ed. Unimed-press, 2003.</li></ol>
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**Self-study assignments**

**Add definitions:**

**Xanthochromia** - \_\_\_\_\_

**Hyperproteinarchy** - \_\_\_\_\_

**Hypoglycoarchy** - \_\_\_\_\_

**CSF (CSF)** - \_\_\_\_\_

**Pleocytosis** - \_\_\_\_\_

**Test tasks:**

**1. Normal protein content in cerebrospinal fluid:**

- A. 0.033-0.1 g / l
- B. Above 0.5g / L
- C. 0.2-0.3 g / l
- D. 0.3-0.5 g / l
- E. Completely missing

**2. Normal glucose in the cerebrospinal fluid**

- A. 2.8-3.9 mmol / l
- B. 3.4-4.9 mmol / l
- C. 1.2-2.9 mmol / l
- D. 0.8-4.2 mmol / l

**3. The normal content of leukocytes in the cerebrospinal fluid**

- A. 10-12L / 3 $\mu$ L
- B. 12-15L / 3 $\mu$ L
- C. 20-30kl / 3mkl
- D. 7-10kl / 3mkl

**4. In the presence of a large number of leukocytes, the cerebrospinal fluid acquires:**

- A. Red color
- B. Greenish yellow color
- C. Dark cherry color
- D. Orange color



**Methodological recommendations for performing extracurricular independent work for a lesson  
on the topic: "CLINICAL STUDIES"**

**Lesson number 4**

**Initial level of knowledge:**

The mechanism of the formation of effusion fluids.

- Physicochemical properties of effusion liquids.
- Microscopic examination.

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"><li>• Differential diagnosis of exudates and transudates<ul style="list-style-type: none"><li>• Physicochemical properties of effusion fluids</li><li>• Microscopic examination</li></ul></li></ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"><li>• Determine the physical properties of effusion fluids<ul style="list-style-type: none"><li>• Work with diagnostic test strips</li><li>• Differentiate exudates and transudates</li></ul></li></ul>	<p><b><u>Main literature:</u></b></p> <p>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T 2. 2. Clinical laboratory diagnostics. Reference book for doctors. St. Petersburg. 1997. Pp. 117-118</p> <p><b><u>Additional literature:</u></b></p> <p>1. Laboratory research methods. V.E. Predtechensky, V.M. Borovskaya, L.T. Margolina. M. 1950. S. 612-617.</p>
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**Self-study assignments**

**Add definitions:**

Transudate is \_\_\_\_\_

Chemical examination of effusion liquids include the definition of \_\_\_\_\_

Exudate is \_\_\_\_\_

Examination of the contents of the serous cavities contributes to the solution  
the following questions \_\_\_\_\_

Serous-purulent and purulent exudates contain a large amount of ...

Chylous exudates are due to the presence of a large amount of ...

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Most often, hemorrhagic exudates occur when ...

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**Test tasks:**

*1. The exudate differs from the transudate:*

1. The number of shaped elements
2. The presence of atypical cells
3. The amount of protein, specific gravity and breakdown of Rivolta
4. The number of plasma cells and lymphocytes.

*2. Relative density of exudate:*

- 1.1005 - 1007
- 2.1015 - 1025
- 3.1000 - 1005
- 4.1000 - 1001

*3. Relative density of the transudate:*

- 1.1005 - 1015
- 2.1015 - 1020
- 3.1020 - 1025
- 4.1025 - 1030

*4. The amount of protein in the transudate:*

- 1.30 - 35 g / l
- 2.5 - 25 g / l
- 3.25 - 35 g / l
- 4.15 - 25 g / l

*5. The amount of protein in the exudate:*

- 1.5 - 10 g / l
- 2.5 - 25 g / l
- 3.25 - 30 g / l
- 4.30 g / l and above

**Methodological recommendations for performing extracurricular independent work for a lesson  
on the topic: "CLINICAL STUDIES"**

**Lesson number 5**

**Initial level of knowledge:**

- Physicochemical properties of sputum.
  - Microscopic examination.
  - Bacterioscopic examination of sputum

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"><li>• Differential diagnosis of exudates and transudates<ul style="list-style-type: none"><li>• Physicochemical properties of effusion fluids</li><li>• Microscopic examination</li></ul></li></ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"><li>• Determine the physical properties of sputum<ul style="list-style-type: none"><li>• Work with diagnostic test strips</li><li>• Interpret analysis results</li></ul></li></ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"><li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T2.</li><li>2. Clinical laboratory diagnostics. Reference book for doctors. St. Petersburg. 1997. Pp. 113-116.</li></ol> <p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"><li>1. Laboratory research methods. V.E. Predtechensky, V.M. Borovskaya, L.T. Margolina. M. 1950.S. 274-278.</li></ol>
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**Self-study assignments**

**Add definitions:**

Sputum is \_\_\_\_\_

Chemical examination of sputum includes the definition of \_\_\_\_\_

Bacterioscopic examination of sputum includes \_\_\_\_\_

What affects the consistency of sputum \_\_\_\_\_

For what diseases does sputum have an unpleasant odor \_\_\_\_\_

In what sputum are Charcot-Leiden crystals present \_\_\_\_\_

**Test tasks:**

*1. Eosinophilia in sputum is characteristic for:*

1. Bronchial asthma
2. Acute bronchitis

3. Chronic bronchitis

4. Pulmonary tuberculosis

2. *The staining method used to detect Mycobacterium tuberculosis:*

1. According to Gram

2. According to Ziehl-Nielsen

3. Methylene blue

4. According to Romanovsky

3. *The concept of "physical properties of sputum" includes:*

1. Quantity

2. Character

3. Smell

4. Consistency

5. Microscopy

4. *Sputum with lung abscess has the consistency:*

1. Liquid, due to blood plasma

2. Thick, due to the presence of pus

3. Viscous due to the presence of mucus.

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Biochemical research methods. Protein metabolism. Determination of total protein, urea and serum creatinine by unified methods. "**

**Lesson number 1**

**Initial level of knowledge:**

- **Protein metabolism**

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"> <li>• Methods for determination of total protein, urea and creatinine.</li> <li>• Clinical and diagnostic value of determination of total protein, urea and creatinine.</li> </ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"> <li>• Interpret biochemical studies of total protein, urea and creatinine.</li> </ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"> <li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T2.</li> <li>2. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T1.107s.</li> <li>3. Clinical biochemistry. Edited by V.A. Tkachuk, M. 2006.</li> </ol> <p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"> <li>1. Tests of blood and urine. Clinical significance. G.I. Kozinets M. 2008.</li> </ol>
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**Self-study assignments**

**Add definitions:**

Proteins    -    \_\_\_\_\_  
 \_\_\_\_\_  
 Urea        -        \_\_\_\_\_  
 \_\_\_\_\_  
 Creatinine    -        \_\_\_\_\_  
 \_\_\_\_\_  
 Albumin      -        \_\_\_\_\_  
 \_\_\_\_\_

### Test tasks:

1. Biochemical analyzers allow:
  - 1) Improve laboratory productivity
  - 2) Conduct research by kinetic methods
  - 3) Expand the range of research
  - 4) Reduce the consumption of reagents
  - 5) All of the above is true
2. The basis of the protein structure is:
  - 1) Polypeptide chain
  - 2) The nucleic acid chain
  - 3) Compounds of keto acids
  - 4) Sialic acids
3. The charge of the protein in the solution depends on:
  - 1) Temperatures
  - 2) pH values of the solution
  - 3) Protein structures
  - 4) The presence of lipids
  - 5) The presence of carbohydrates
4. The reason for the increase in total whey protein cannot be:
  - 1) Multiple myeloma
  - 2) Acute infection
  - 3) Paraproteinemic hemoblastosis
  - 4) Hyperhydration
  - 5) Dehydration
2. Urea does not rise when:
  - 1) Bronchitis
  - 2) Extensive burns
  - 3) Acute renal failure
  - 4) Chronic nephritis
  - 5) Pyelonephritis
6. Creatinine is:
  - 1) Osmotic diuretic
  - 2) a regulator of the activity of the central nervous system
  - 3) The end product of creatine metabolism
  - 4) Catalyst for intermediate reactions
  - 5) All of the above is true

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Determination of the activity of enzymes (aminotransferases, amylases, alkaline and acid phosphatases) by unified methods."**

**Lesson number 2**

**Initial level of knowledge:**

- **The value of determining the activity of enzymes in blood plasma (serum)**

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"> <li>• Methods for determining the activity of enzymes.</li> <li>• Clinical and diagnostic value of enzyme activity.</li> </ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"> <li>• Interpret biochemical study of enzyme activity</li> </ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"> <li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999.</li> <li>2. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000.</li> <li>3. Clinical biochemistry. Ed. Member - corr. RAS., Acad. RAMS V.A. Tkachuk</li> </ol> <p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"> <li>1. Tests of blood and urine. Clinical significance. G.I. Kozinets M. 2008.</li> </ol>
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**Self-study assignments**

**Add definitions:**

Enzymes (enzymes) - \_\_\_\_\_

In accordance with the nature of the reactions catalyzed by enzymes, 6 main types of enzymes are distinguished: \_\_\_\_\_

Methods for determining enzyme activity used in the CDL: \_\_\_\_\_

Enzyme activity is expressed by ... \_\_\_\_\_

ALT - \_\_\_\_\_

AST - \_\_\_\_\_

Amylase \_\_\_\_\_

Acid phosphatase - \_\_\_\_\_

Alkaline phosphatase \_\_\_\_\_

**Test tasks:**

1. For diagnostic purposes, enzyme activity is determined in:
  - A. Blood serum
  - B. Liquore
  - B. Leucoconcentrates
  - G. Biopsy
  - E. All of the above is true.
2. Upon delivery of blood for research, the activity of enzymes may change as a result of:
  - A. Activation of plasma proteolytic systems
  - B. Destruction of the quaternary structure of enzymes
  - B. Changes in blood pH
  - D. Partial hemolysis of erythrocytes
  - E. All of the above is true
3. The source of analytical errors in determining the activity of enzymes can be:
  - A. Concentration of the substrate not saturating the enzyme
  - B. Changing the pH of the incubation mixture
  - B. Temperature instability during incubation
  - D. Use of reagents with an expired shelf life
  - E. All of the above



**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Carbohydrates. Lipids. Methods for the study of pigment metabolism".**

**Lesson number 3**

**Initial level of knowledge:**

- Carbohydrates and their functions
- Lipid metabolism
- The role of lipids in the body
- Methodology for the study of total lipids and their fractions
- Methods for the study of pigment metabolism
- Significance of determination of bilirubin in blood serum.

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"> <li>• Functions of carbohydrates <ul style="list-style-type: none"> <li>• Methods for establishing blood glucose concentration</li> <li>• Glucose metabolism</li> <li>• Hormones that affect blood glucose levels</li> <li>• Increased glucose levels (causes) <ul style="list-style-type: none"> <li>• Lipids and their classification</li> <li>• The role of lipids in the body</li> <li>• Methods for the study of lipids and their fractions</li> <li>• Clinical and diagnostic value of determining the level of total lipids in plasma (serum) <ul style="list-style-type: none"> <li>• Methods for determining bilirubin.</li> <li>• Clinical and diagnostic value of bilirubin.</li> </ul> </li> </ul> </li> </ul> </li> </ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"> <li>• Evaluate lipid metabolism disorders <ul style="list-style-type: none"> <li>• Determine lipids and their fractions</li> <li>• Interpret the biochemical test of bilirubin.</li> </ul> </li> </ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"> <li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999</li> <li>2. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000</li> <li>3. Clinical biochemistry. Edited by V.A. Tkachuk. M.2006.</li> </ol> <p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"> <li>1. Tests of blood and urine. Clinical significance. G.I. Kozinets M. 2008.</li> </ol>
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## Self-study assignments

### Add definitions:

Carbohydrates \_\_\_\_\_

Lactic acid - \_\_\_\_\_

Bilirubin \_\_\_\_\_

The role of lipids in the body \_\_\_\_\_

List the functions of carbohydrates \_\_\_\_\_

Glucose and its role in the body \_\_\_\_\_

List methods for establishing blood glucose concentration \_\_\_\_\_

List the methods for studying total lipids and their fractions \_\_\_\_\_

### Test tasks:

1. 1. Carbohydrates are absorbed in the form of:
  - 1) Starch
  - 2) Fiber
  - 3) Oligosaccharides
  - 4) Monosaccharides
  - 5) Polysaccharides
2. Glucosuria can occur when:
  - 1) Normoglycemia
  - 2) Significant hyperglycemia
  - 3) Slight hyperglycemia
  - 4) Hypoglycemia
  - 5) All of the above conditions
3. A moderate increase in the content of unconjugated bilirubin in the blood occurs when:
  - 1) increased destruction of red blood cells;
  - 2) competitive displacement of unconjugated bilirubin from the bond with albumin;
  - 3) impaired uptake of unconjugated bilirubin from the blood by hepatocytes;
  - 4) insufficient activity of uridine diphosphate-glucuronyltransferase of hepatocytes;
  - 5) All of the above is true
4. Norms of bilirubin in the blood of a healthy person:
  - 1) 6.5 - 8.5  $\mu\text{mol} / \text{l}$
  - 2) 1.7 - 21  $\mu\text{mol} / \text{l}$
  - 3) 10.0 - 18.0  $\mu\text{mol} / \text{l}$

4) 9.5 - 25.5  $\mu\text{mol} / \text{l}$

5) 8.5 - 20.5  $\mu\text{mol} / \text{l}$

**Methodical recommendations for performing extracurricular independent work for the lesson on the topic: "Methods for the study of acid-base balance"**

**Lesson number 4**

**Initial level of knowledge:**

- The concept of water and mineral exchange
- Methods for the study of acid-base balance

<b><u>The student should know:</u></b> <ul style="list-style-type: none"><li>• Buffering systems of blood<ul style="list-style-type: none"><li>• ABB parameters</li><li>• ABB methods</li></ul></li></ul> <b><u>The student should be able to:</u></b> <ul style="list-style-type: none"><li>• Correctly interpret the results of the acid balance</li></ul>	<b><u>Main literature:</u></b> <ol style="list-style-type: none"><li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. T 2.</li><li>2. Clinical biochemistry. Edited by V.A. Tkachuk, M. 2006</li><li>3. Handbook of clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T1.107s.</li></ol> <b><u>Additional literature:</u></b> <ol style="list-style-type: none"><li>1. Tests of blood and urine. Clinical significance. G.I. Kozinets M. 2008.</li><li>2. Research of the blood system in clinical practice. Edited by G.I. Kozintsa, V.A. Makarov. M. Triad-X, 1997.</li></ol>
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**Self-study assignments**

**Add definitions:**

1. As a result of metabolic processes in the body ... \_\_\_\_\_

2. The pH of the blood depends on \_\_\_\_\_

3. Hypoventilation \_\_\_\_\_

4. Hyperventilation \_\_\_\_\_

5. Why is it necessary to determine the ABB? \_\_\_\_\_

6.

Primary respiratory abnormality of acid-base balance is \_\_\_\_\_

7. The primary change in bicarbonate concentration is \_\_\_\_\_

**Test tasks:**

1. 1. Violation of the water balance may be accompanied by a change:
  - 1) Hematocrit
  - 2) Hemoglobin
  - 3) KShchR
  - 4) Total protein
  - 5) All of the above is true
2. The highest potassium content is noted:
  - 1) Erythrocytes
  - 2) Blood plasma
  - 3) Liquor
  - 4) Intercellular fluid
  - 5) Cardiomyocytes
3. Changes in the content of the bicarbonate anion in plasma are most characteristic for: Shifts in the acid-base state
  - 1) Hypokalemia
  - 2) Hyperglycemia
  - 3) Dysproteinemia
  - 4) hyperlipidemia

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Immunohematology. Determination of blood groups according to the ABO system "**

**Lesson number 1**

**Initial level of knowledge:**

- The concept of blood groups
  - Erythrocyte antigens
  - Plasma agglutinins
  - Determination of the blood group according to the ABO system

<b><u>The student should know:</u></b> <ul style="list-style-type: none"><li>• Erythrocyte antigens.</li><li>• Plasma agglutinins.</li><li>• Rh antigen accessories.</li></ul>	<b><u>Main literature:</u></b> <ol style="list-style-type: none"><li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999.T 2.</li><li>2. Hematological analyzers. Interpretation of a blood test. Guidelines. S. A. Lugovskaya, M. E. Postman, V.V. Dolgov. M., 2008, 28s.</li><li>3. Laboratory hematology. A. Lugovskaya, V. T. Morozova, M. E. Postman, V.V. Dolgov, M. 2006. With. 7-</li></ol>
<b><u>The student should be able to:</u></b> <ul style="list-style-type: none"><li>• Correctly determine the blood group under study according to the ABO system</li></ul>	<b><u>Additional literature:</u></b> <ol style="list-style-type: none"><li>1. Research of the blood system in clinical practice. Edited by G.I. Kozintsa, V.A. Makarov. M. Triad-X, 1997.</li></ol>

**Self-study assignments**

**Add definitions:**

**What agglutinins will be in serum with this blood group:**

1.O(I)\_\_\_\_\_

\_\_\_\_\_

2.A(II)\_\_\_\_\_

\_\_\_\_\_

3.B(III)\_\_\_\_\_

\_\_\_\_\_

4. AB (IV)\_\_\_\_\_

\_\_\_\_\_

5. Why is the determination of erythrocyte antigen D necessary? \_\_\_\_\_

\_\_\_\_\_

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6. How to correctly determine the blood group by the cross method?

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**Test tasks:**

1. 1. The definition of group affiliation is based on the reaction:
  - 1) precipitation
  - 2) Agglutination
  - 3) Aggregations
  - 4) Immunodiffusion
  - 5) All of the above is true
2. Central organs of the immune system:
  - 1) Thymus, bone marrow
  - 2) Liver
  - 3) Lymph nodes
  - 4) Spleen
  - 5) Peyer's patches of the ileum
3. Human B-lymphocytes come from:
  - 1) Unipotent precursors of B-lymphocytes of lymph nodes
  - 2) Unipotent precursors of B-lymphocytes of the bone marrow
  - 3) Unipotent precursors of the B-lymphocyte brain with subsequent maturation in the thymus
  - 4) Multipotent stem cells followed by maturation in the spleen

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Methods of enzyme immunoassay. ELISA research of thyroid hormones".**

**Lesson number 2**

**Initial level of knowledge:**

- The principle of work when performing ELISA studies
- ELISA studies of thyroid hormones

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"><li>• Methods of enzyme immunoassay</li><li>• ELISA studies of thyroid hormones</li></ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"><li>• Interpret ELISA studies</li></ul>	<p><b><u>Main literature:</u></b></p> <ol style="list-style-type: none"><li>1. Clinical laboratory analytics. Ed. V.V. Menshikov. Moscow, 1999, T</li><li>2. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T1.107s.</li><li>3. Immunological and serological studies in clinical practice. A.A. Kishkun, M. 2006.</li></ol> <p><b><u>Additional literature:</u></b></p> <ol style="list-style-type: none"><li>1. Tests of blood and urine. Clinical significance. G.I. Kozinets M. 2008.</li></ol>
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**Self-study assignments**

**Add definitions:**

**Humoral immunity -** \_\_\_\_\_

**Cellular immunity -** \_\_\_\_\_

**Antibodies to thyroid peroxidase is a diagnosis ...** \_\_\_\_\_

**An increase in thyroid-stimulating hormone is ...** \_\_\_\_\_

**A decrease in T4 free is ...** \_\_\_\_\_

**Test tasks:**

1. Central organs of the immune system:
  - 1) Thymus, bone marrow
  - 2) Liver



- 3) Lymph nodes
- 4) Spleen
- 5) Peyer's patches of the ileum
- 2. Human B-lymphocytes come from:
  - 1) Unipotent precursors of B-lymphocytes of lymph nodes
  - 2) Unipotent precursors of B-lymphocytes of the bone marrow
  - 3) Unipotent precursors of the B-lymphocyte brain with subsequent maturation in the thymus
  - 4) Multipotent stem cells followed by maturation in the spleen
- 3. The thyroid gland produces:
  - 1) Triiodothyronine, thyroxine
  - 2) thyroid stimulating hormone
  - 3) Thyreoliberin
  - 4) ACTH
  - 5) Melanin
- 4. The total thyroxine is increased at:
  - 1) Myxedeme
  - 2) When treating with triiodothyronine
  - 3) Hyperthyroidism
  - 4) Significant iodine deficiency
  - 5) All of the above is true

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Hemostasis system. The main links of the hemostasis system. The norm and pathology of the hemostasis system "**

**Lesson number 1**

**Initial level of knowledge:**

- Hemostasis system
- Clotting factors
- Internal and external mechanism of activation of the hemostasis system
- Norm and pathology of the hemostasis system

<b><u>The student should know:</u></b> <ul style="list-style-type: none"><li>• Clotting factors<ul style="list-style-type: none"><li>• Internal and external mechanism of activation of the hemostasis system</li><li>• Norm and pathology of the hemostasis system</li></ul></li></ul>	<b><u>Main literature:</u></b> <ol style="list-style-type: none"><li>1. Laboratory diagnostics of hemostasis disorders. V.V. Dolgov, P.V. Svirin M. 2005</li><li>2. Clinical laboratory analytics. Ed. V.V. Menshikov. Moscow, 1999, T</li><li>3. Reference book on clinical and biochemical laboratory diagnostics. V.S. Kamyshnikov. Belarus, 2000. T1.107s.</li><li>4. Immunological and serological studies in clinical practice. A.A. Kishkun, M. 2006.</li></ol> <b><u>Additional literature:</u></b> <ol style="list-style-type: none"><li>1. Tests of blood and urine. Clinical significance. G.I. Kozinets M. 2008.</li></ol>
<b><u>The student should be able to:</u></b> <ul style="list-style-type: none"><li>• Determine blood coagulation factors (prothrombin index, APTT, INR)</li></ul>	

**Self-study assignments**

**Add definitions:**

Hemostasis system - \_\_\_\_\_

Primary hemostasis (vascular-platelet link) - \_\_\_\_\_

List the primary physiological anticoagulants \_\_\_\_\_

Plasma (coagulation) hemostasis \_\_\_\_\_

List the clotting factors \_\_\_\_\_

List the tests to characterize the plasma-coagulation link of hemostasis: \_\_\_\_\_

RFMK is \_\_\_\_\_

**Test tasks:**

1. *The hemostasis system includes:*
  - 1) *Fibrinolysis factor*
  - 2) *Plasma factors*
  - 3) *Anticoagulants*
  - 4) *Platelets*
  - 5) *All of the above*
2. *Prothrombin formation along the internal pathway should be controlled:*
  - 1) *Aggregation of platelets*
  - 2) *Determination of fibrinogen*
  - 3) *Activated partial thromboplastin time*
  - 4) *Prothrombin time*
  - 5) *Time of bleeding*
3. *Diagnostic value of protein C determination:*
  - 1) *Identifying the risk of thrombosis*
  - 2) *Criterion for increasing or decreasing the dose of indirect anticoagulants*
  - 3) *Evaluation of fibrinolysis*
  - 4) *Control of heparin therapy*
  - 5) *All of the above is true*

**Methodical recommendations for performing extracurricular independent work for a lesson on the topic: "Cytological research".**

**Lesson number 1**

**Initial level of knowledge:**

- Morphology of cellular elements in health and disease
  - Cytological research methods

<p><b><u>The student should know:</u></b></p> <ul style="list-style-type: none"><li>• The morphology of cellular elements is normal<ul style="list-style-type: none"><li>• Morphology of cellular elements in pathology</li></ul></li></ul> <p><b><u>The student should be able to:</u></b></p> <ul style="list-style-type: none"><li>• Interpret the results of cytological studies</li></ul>	<p><b><u>Main literature:</u></b></p> <ul style="list-style-type: none"><li>• Interpret the results of cytological studies</li></ul> <p><b><u>Additional literature:</u></b></p> <p>1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999.</p>
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**Self-study assignments**

**Add definitions:**

**Alveolar macrophages originate from ...** \_\_\_\_\_

\_\_\_\_\_

**Cancer develops from ...** \_\_\_\_\_

\_\_\_\_\_

**Cytology is** \_\_\_\_\_

\_\_\_\_\_

**Cytological studies are applied ...** \_\_\_\_\_

\_\_\_\_\_

**For malignant tumors, the most typical ...** \_\_\_\_\_

\_\_\_\_\_

### Test tasks:

1. 1. The characteristic signs for malignant tumors are:
  - 1) Impaired differentiation
  - 2) Polymorphism
  - 3) Anisochromia
  - 4) All the listed signs
  - 5) None of the listed signs
2. Of the listed signs, the most characteristic of tumor cells are:
  - 1) Dystrophy
  - 2) Impaired differentiation
  - 3) Vacuolization
  - 4) Hyperchromia of the nuclei
  - 5) Hyperchromia of the cytoplasm
3. The following morphological features should be attributed to cell polymorphism:
  - 1) Variety of cell shapes
  - 2) Variety of cell sizes
  - 3) The difference in the degree of maturation of individual cells
  - 4) All the listed signs
  - 5) None of the listed signs
4. In the bladder, the most common:
  - 1) Transitional cell tumors
  - 2) Connective tissue tumors
  - 3) Squamous cell tumors
  - 4) Vascular tumors
  - 5) All answers are correct

**Methodical recommendations for performing extracurricular independent work for the lesson on the topic: "Methods of molecular genetic research."**

**Lesson number 2**

**Initial level of knowledge:**

- Polymerase chain reaction
- Methods of polymerase chain reaction

<b><u>The student should know:</u></b> <ul style="list-style-type: none"><li>• Polymerase chain reaction</li><li>• Methods of molecular genetic research</li></ul> <b><u>The student should be able to:</u></b> <ul style="list-style-type: none"><li>• Interpret research results</li></ul>	<b><u>Main literature:</u></b> 1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. 2. Immunological and serological studies in clinical practice. A.A. Kishkun, M. 2006. <b><u>Additional literature:</u></b>
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**Self-study assignments**

**Add definitions:**

Polymerase chain reaction (PCR) is a method \_\_\_\_\_

The DNA cloning method allows ... \_\_\_\_\_

It is possible to make a genetic prognosis of health if \_\_\_\_\_

**Test tasks:**

**1. Advantages of PCR in the diagnosis of infectious diseases:**

- 1) The causative agent of infection can be detected in any biological environment of the body
- 2) Diagnosis of infectious diseases in the early stages of the disease
- 3) Ability to quantify research results
- 4) High sensitivity of the method
- 5) All of the above

**2. Detection by PCR method indicates:**

- 1) About viremia
- 2) Allows you to judge the replication of the virus
- 3) Criterion of the effectiveness of antiviral therapy
- 4) There is no right answer
- 5) All answers are correct

**Methodical recommendations for performing extracurricular independent work for the lesson on the topic: "Methods of bacteriological research."**

**Lesson number 3**

**Initial level of knowledge:**

- Methods of bacteriological research

<b><u>The student should know:</u></b> <ul style="list-style-type: none"><li>• Bacteriological research methods</li></ul> <b><u>The student should be able to:</u></b> <ul style="list-style-type: none"><li>• Interpret research results</li></ul>	<b><u>Main literature:</u></b>  1. Clinical laboratory analytics. Ed. V.V. Menshikov. M., 1999. 2. Immunological and serological studies in clinical practice. A.A. Kishkun, M. 2006. <b><u>Additional literature:</u></b>
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**Self-study assignments**

**Add definitions:**

What method is used to isolate a pure culture, with severe contamination of pathological material -

\_\_\_\_\_

The enrichment medium is necessary for ... \_\_\_\_\_

At the second stage of the bacteriological research method, ... \_\_\_\_\_

**Test tasks:**

1. Bacteriological examination of clinical material consists of several stages:
  - 1) Sampling for research;
  - 2) Sowing on nutrient media;
  - 3) Isolation of pure culture;
  - 4) Identification and differentiation of isolated cultures of microorganisms;
  - 5) Analysis of research results
  - 6) All of the above is true
2. The bacteriological method consists of:
  - 1) In the isolation of a pure culture of the pathogen
  - 2) Identification of this pathogen
  - 3) In sowing on nutrient media
  - 4) All answers are correct