

**MINISTRY OF HEALTH CARE  
OF THE REPUBLIC OF BELARUS  
VITEBSK STATE MEDICAL UNIVERSITY  
THE GENERAL HYGIENE AND ECOLOGY DEPARTMENT**

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# **LABORATORY CLASSES ON HYGIENE**

Recommended by Education and methodical association of the Republic of Belarus of medical education in specialty 1-79 01 01 «General medicine» as manual for students of high educational establishments

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The content of the manual «Laboratory classes on hygiene» for students of high medical educational establishments corresponds with the basic educational plan and program, approved by Ministry of Health Care of the Republic of Belarus.

The manual is prepared for students of medical, pharmaceutical, dental, medical-preventive, medical-diagnostic faculties of institutes of higher education.

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**Laboratory classes № 1.**  
**The topic: HYGIENIC ESTIMATION  
OF POPULATION'S HEALTH**

*The theme has important meaning for further training at department of organization of public health services and public health, in practical work for analysis of activity of treatment-preventive establishments.*

**Aim of the Lesson:** to be able to determine the health parameters and to propose measures of its rationalization.

**Checking Questions.**

- ✓ 1. Principles of the state policy in the field of public health care in the Republic of Belarus.
- ✓ 2. Hygiene as a science. Subject of hygiene is health and environment. Purpose, tasks, differentiation of hygiene, communication with other sciences.
- ✓ 3. Methodology and theoretical bases of hygiene.
- ✓ 4. History of hygiene development. Features of hygiene development at the present stage.
- ✓ 5. Value of hygiene in maintenance of population's health.
- ✓ 6. Methods of study and estimation of population's health.

**Multiple Choice Questions.**

**Choose proper answers**

1. Hygiene is a science about:
  - 1) laws of environment factors influence on individual and public health and conditions of its maintenance and strengthening;
  - 2) practical actions directed on carrying out in life of the hygienic requirements;
  - 3) diseases prevention;
  - 4) strengthening of health;
  - 5) factors which influence organism.
2. Tasks of hygiene are:
  - 1) studying of factors which influence organism;
  - 2) revealing of risk factors and carrying out of hygienic diagnostics;
  - 3) working out and introduction of specifications on safety and harmlessness of factors for an organism;

- 4) working out and introduction of actions for population and environment improvement;
- 5) forecasting of situation for nearest and remote prospect.
3. Laboratory researches can be performed with the following methods:
  - 1) physical;
  - 2) chemical;
  - 3) biological;
  - 4) bacteriological;
  - 5) mathematical.
4. Sanitary is:
  - 1) set of practical actions directed on carrying out in life of the hygiene requirements;
  - 2) laws of environment factors influence on individual and public health and conditions of its preservation and strengthening;
  - 3) practical actions directed on carrying out in life of the hygiene requirements;
  - 4) diseases prevention;
  - 5) strengthening of health.
5. Social and hygienic monitoring includes:
  - 1) ecological supervision over air environment and water;
  - 2) supervision over radiating air pollution, soils and waters;
  - 3) supervision over social labor sphere;
  - 4) sanitary and epidemiologic supervision over food and water supply of population;
  - 5) supervision over morbidity, physical development, demographic indicators of population.
6. Hygienic normalization is:
  - 1) establishment of harmless and safe levels of environment factors influence on a person in legislative order;
  - 2) maximum physiologically safe for an organism quantitative level of harmful factor;
  - 3) establishment of cause and effect relationships between influence of environment factors and state of health;
  - 4) diagnostics of environment condition;
  - 5) estimation of exposition and its levels.
7. Hygienic normative is:
  - 1) maximum physiologically harmful for an organism quantitative level of some physical factor;
  - 2) lethal dose of harmful factor;



- 3) such a level of harmful factor that provides damage of nervous system;
  - 4) maximum physiologically safe for an organism quantitative level of harmful factor;
  - 5) maximum quantitative level of harmful factor.
- 8. Person's health is:**
- 1) condition of full physical, mental and social wellbeing;
  - 2) absence of illnesses;
  - 3) condition when nothing disturbs a person;
  - 4) absence of physical defects;
  - 5) condition when a person suffers from chronic diseases.
- 9. Demographic indications of population's health are:**
- 1) birth rate;
  - 2) death rate;
  - 3) morbidity;
  - 4) population natural increase;
  - 5) average lifetime.
- 10. Hygienic diagnostics includes:**
- 1) diagnostics of environment condition;
  - 2) estimation of exposition and its levels;
  - 3) diagnostics of state of person's health and population as a whole;
  - 4) communication diagnostics between environment factors and health;
  - 5) establishment of contribution of environment factors in etiology of health infringements.
- 11. Population's health is:**
- 1) absence of illnesses;
  - 2) condition when nothing disturbs a person;
  - 3) condition of full wellbeing on demographic indications, morbidity, physical inabilities, traumatism and physical development;
  - 4) absence of physical defects;
  - 5) condition when a person suffers from chronic diseases.
- 12. Kinds of morbidity are:**
- 1) primary;
  - 2) secondary;
  - 3) general;
  - 4) professional;
  - 5) medical.
- 13. Factors influencing on health are:**
- 1) ecological;

- 2) chemical;
- 3) social and economic;
- 4) biological;
- 5) psycho emotional.

**14. Basic hygienic laws are:**

- 1) the law of health infringement;
- 2) the law of harmful substances;
- 3) the law of influence of environment on health;
- 4) the law of person's influence on environment;
- 5) the law of biological adequacy.

**15. The hygienic method of health studying includes:**

- 1) statistical research of health;
- 2) epidemiological studying of health;
- 3) medical examination of population;
- 4) clinical supervision over separate groups;
- 5) method of animal testing.

**Laboratory Work.**

- 1. Determine primary and general sick rate of students.
- 2. Estimate the received results.
- 3. Offer actions for students' health improvement.
- 4. Record the laboratory work report.

***Determination of primary and general sick rate.***

Equipment: microcalculators, patient's medical cards.

Work performance:

a. in patient's medical card the information about the number of acute diseases (revealed for the first time in the current year) and the number of first visits to a doctor concerning chronic diseases in the current year are found out;

b. determination of primary sick rate is calculated according the formula:

$$\text{PSR} = A \times 1000 / N$$

where A - the number of acute diseases (revealed for the first time in the in the current year),

N – the number of patients.

c. determination of general sick rate is calculated according the formula:

$$\text{GSR} = (A + B) \times 1000 / N$$

where A - the number of acute diseases (revealed for the first time in the current year),

B - the number of first visits to a doctor concerning chronic diseases in the current year,

N – the number of patients.

*Hygienic estimation.*

The received parameters of general and primary morbidity are compared with the average levels of the Republic of Belarus.

Average parameter of primary morbidity – 859 ‰,

Average parameter of general morbidity – 1527 ‰.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

In the city with the population 300000 persons 5000 persons have died, 2440 children were born, 400000 cases of chronic diseases and 280000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general sick rate of the population and to suggest improvement actions.

*The algorithm of task's solution:*

General birth rate =  $2440: 300000 \times 1000 = 8.1 \text{ ‰}$ .

General death rate =  $5000: 300000 \times 1000 = 16.6 \text{ ‰}$ .

Population natural increase =  $8.1 - 16.6 = - 8.5 \text{ ‰}$ .

Primary sick rate =  $280000: 300000 \times 1000 = 933.3 \text{ ‰}$ .

General sick rate =  $280000+400000: 300000 \times 1000 = 2266.6 \text{ ‰}$ .

General birth rate in the city is less than average indicator of birth rate (average indicator is 9.1 ‰), general death rate exceeds the average indicator of death rate in the Republic of Belarus (average indicator is 14.3 ‰). Natural increase in the city is 8.1 ‰ and less than average indicator, in the Republic of Belarus 5.2 ‰. Primary sick rate in the city is more than average (average indicator is 715.3 ‰), general sick rate is also more than average in the Republic of Belarus (average indicator is 1311.25 ‰).

It is necessary to create the conditions and interest of the population in birth rate increase. The population should carry on healthy lifestyle. In the city it is necessary to carry out actions for maintenance of environment

from pollution, to raise public health services system effectiveness, to spend preventive work of disease prevention.

**1.** In the city with the population 900000 persons 8000 persons have died, 1110 children were born, 18000 cases of chronic diseases and 8000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general morbidity of the population and to suggest improvement actions.

**2.** In the city with the population 1300000 persons 9000 persons have died, 4110 children were born, 50000 cases of chronic diseases and 9000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general morbidity of the population and to suggest improvement actions.

**3.** In the city with the population 300000 persons 200 persons have died, 211 children were born, 1000 cases of chronic diseases and 200 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general morbidity of the population and to suggest improvement actions.

**4.** In the city with the population 1000000 persons 7000 persons have died, 2118 children were born, 18000 cases of chronic diseases and 6000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general morbidity of the population and to suggest improvement actions.

**5.** In the city with the population 400000 persons 3800 persons have died, 1910 children were born, 13000 cases of chronic diseases and 8000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general morbidity of the population and to suggest improvement actions.

**6.** In the city with the population 500000 persons 3900 persons have died, 2100 children were born, 14000 cases of chronic diseases and 9000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general morbidity of the population and to suggest improvement actions.

**7.** In the city with the population 5000000 persons 120000 people have died 20000 children were born, 600000 cases of chronic diseases and 80000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general morbidity of the population and to suggest improvement actions.

**8.** In the city with the population 10000000 persons 15000 people have died 1500 children were born, 85000 cases of chronic diseases and 150000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general disease of the population and to suggest improvement actions.

**9.** In the city with the population 80000 persons 1000 people have died 1000 children were born, 15000 cases of chronic diseases and 45000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general disease of the population and to suggest improvement actions.

**10.** In the city with the population 380000 persons 700 people have died 1300 children were born, 80000 cases of chronic diseases and 100000 cases of acute diseases are registered for 1 year. To give the hygienic estimation of birth rate, death rate, natural increase, primary and general disease of the population and to suggest improvement actions.

#### **The literature.**

1. Lecture №1.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 4–16.

**Laboratory classes № 2.****The topic: HYGIENIC VALUE OF ENVIRONMENT**

*The theme has great value for further training at clinical departments, in practical work of a doctor for hygienic diagnostic.*

**Aim of the Lesson:** to be able to assess environment factors and to propose actions for prevention of their adverse influence on health.

**Checking Questions.**

- ✓ 1. Hygiene of environment as a science. Value of Hygiene of environment for the doctor.
- ✓ 2. Hygienic value of physical factors of atmospheric air, water and soil.
- ✓ 3. Hygienic value of chemical factors of atmospheric air, water and soil.
- ✓ 4. Hygienic value of biological factors of atmospheric air, water and soil.
- ✓ 5. Prevention of adverse influence of environment factors and pollutants on health. Value of ecological medicine in prevention of environment diseases.
- ✓ 6. Methods of studying and estimation of environment factors.

**Multiple Choice Questions.****Choose proper answers**

1. Microbiological objects of air are:
  - 1) bacteria;
  - 2) barmy mushrooms;
  - 3) mycelial fungus;
  - 4) monocelled seaweed;
  - 5) disputes.
2. Joint influence of environment factors are:
  - 1) combined;
  - 2) compound;
  - 3) associative;
  - 4) simple;
  - 5) complex.
3. Influence of magnetic storms on an organism:
  - 1) amplifications of processes of braking in CNS;
  - 2) increase of frequency of aggravations of psychological diseases;
  - 3) deterioration of the general state of health;

- 4) decrease in serviceability;
  - 5) reduction of frequency of aggravations of cardiovascular diseases.
- 4. Cold action causes:**
- 1) vasomotor spasms;
  - 2) fever;
  - 3) loss of skin's sensitivity;
  - 4) swelling of fingers of hands, feet;
  - 5) frostbiting.
- 5. Influence of carbonic oxide on human body:**
- 1) nausea;
  - 2) headache;
  - 3) weakness;
  - 4) respiratory depression;
  - 5) pressure fall.
- 6. Ecological diseases are:**
- 1) acrodynia;
  - 2) illness of Minimat;
  - 3) illness of Yusho;
  - 4) illness of BeriBeri;
  - 5) illnesses of itajitaj.
- 7. Biological factors of water sphere are:**
- 1) oxygen mode;
  - 2) carbon dioxide mode;
  - 3) microorganisms;
  - 4) plants;
  - 5) animals.
- 8. The characteristic of underground sources water of the 1 class:**
- 1) color - no more than 20° ;
  - 2) hardness – 1,5 mg/l;
  - 3) pH – 9-12;
  - 4) iron – 3 mg/l;
  - 5) chlorides - 500 mg/dm<sup>3</sup>.
- 9. Strongly mineralized water causes:**
- 1) dehydration of an organism;
  - 2) infringement of acid and alkaline balance;
  - 3) easing of intimate activity;
  - 4) infringement of thermoregulation;
  - 5) appearance of endemic diseases.
- 10. Systematic usage of hard water by a person can lead to:**
- 1) dyspepsia phenomena;

- 2) infrigement of CNS functions;
  - 3) urolithiasis;
  - 4) methaemoglobinemia;
  - 5) convulsive illnesses.
- 11.** Water is the basic source of receipt in organism:
- 1) calcium;
  - 2) potassium;
  - 3) fluorine;
  - 4) iodine;
  - 5) strontium.
- 12.** Fluorine participates in:
- 1) development of skeleton;
  - 2) development of teeth;
  - 3) stimulations of haemopoiesis;
  - 4) stimulations of immunity;
  - 5) development of endemic goiter.
- 13.** At superfluous fluorine receipt in an organism the following diseases can be:
- 1) caries of teeth;
  - 2) fluorosis;
  - 3) anaemia;
  - 4) B<sub>12</sub> hypovitaminosis;
  - 5) haemohromatosis.
- 14.** Hygienic requirements to water:
- 1) should be colourless;
  - 2) transparent;
  - 3) should not to have a smell;
  - 4) to possess of pleasant freshening taste;
  - 5) to have a natural chemical compound.
- 15.** Influence of carbonic oxide on a human body:
- 1) nausea;
  - 2) headache;
  - 3) weakness;
  - 4) respiratory depression
  - 5) pressure fall.

### **Laboratory Work.**

- 1. Determine temperature, relative humidity, speed of air movement, atmospheric pressure of air, smell, taste, chromaticity, turbidity of water.



- 2. Estimate the received results.
- 3. Offer actions for prevention of adverse influence of environment factors on health.
- 4. Record the laboratory work report.

### *Determination of air temperature.*

Equipment: thermometer TET-TS11.

Work performance:

- a. the thermometer gauge is established in the investigated place;
- b. the thermometer is switched on;
- c. the readings at the screen of the measuring block are taken in 30 seconds;
- d. the thermometer is switched off after work.

### *Hygienic estimation.*

The received parameters of atmospheric air temperature are compared with the optimum ones - 20<sup>0</sup>C (15-25<sup>0</sup>C).

### *Determination of relative humidity.*

Equipment: hygrometer (figure 1).

Work performance:

- a. the hygrometer is established in the investigated place;
- b. the investigator knock on its glass by finger;
- c. the arrow indications are written down.



**Figure 1.** Hygrometer.

### *Hygienic estimation.*

The received parameters of relative humidity are compared with the

optimum ones - 50 % (40-60 %).

***Determination of speed of air movement.***

Equipment: anemometer АП-1 (figure 2).

Work performance:

- a. the anemometer is established perpendicularly to air current direction in the investigated place;
- b. the device is switched on;
- c. the readings from the screen of measuring block are taken in 30 seconds.



**Figure 2.** Anemometer АП-1.

***Hygienic estimation.***

The received parameters of speeds of air movement are compared with the optimum ones - 2.5 m/s (1-4 m/s).

***Determination of atmospheric pressure.***

Equipment: barometer-aneroid.

Work performance:

- a. the barometer is established in the investigated place;
- b. the investigator knock on its glass by finger;
- c. the arrow indications are written down.

***Hygienic estimation.***

The received parameters of atmospheric pressure are compared

with the optimum ones - 760 mm hg (740-780 mm hg).

***Determination of water smell.***

Equipment: conical flask, hotplate, hour glass.

Work performance:

- a. the sampling of water is carried out in flask, closed with plug, shook up and smell is analyzed with the opened plug;
- b. for strengthening of the smell 100 sm<sup>2</sup> of investigated water is poured in flask, cover with hour glass, warm up it up to 50-60°C;
- c. the flask is removed, water is shook up, hour glass is removed;
- d. the character (chemist's, earthy, chloral, etc.) and intensity of smell are defined on the five-point system:
  - there is no smell - 0 points;
  - very weak, found out by the habitual observer - 1 point;
  - weak, found out at the reference of attention on it - 2 points;
  - appreciable, causing the disapproving responses - 3 points;
  - distinct, sometimes causing refusal of drink - 4 points;
  - very strong, water is not suitable for drink - 5 points.

***Hygienic estimation.***

The smell of water should not exceed 2 points for the centralized sources and 2 - 3 points - for decentralized.

***Determination of water taste.***

Equipment: chemical glasses.

Work performance:

- a. the water is taken in a mouth in the small portions, hold in a mouth in some seconds and taste is defined, not swallowing it;
- b. the characteristic of taste is described according to sensation as salty, bitter, sweet, sour;
- c. after-taste are characterized as fish, metal, chlorine, etc.
- d. intensity of taste and after-taste are estimated on the five-point system:
  - there is no smack - 0 points;
  - very weak - 1 point;
  - weak - 2 points;
  - appreciable - 3 points;
  - distinct - 4 points;
  - very strong - 5 points.

Taste of obviously harmless water is defined during the moment

of the sampling of water. In case of suspicion on pollution definition of taste is made in the boiled and cooled water.

*Hygienic estimation.*

Potable water should have pleasant fresh taste.

Intensity of taste and after-taste of water should not exceed 2 points for the centralized sources and 2 - 3 points - for decentralized.

***Determination of water chromaticity.***

Equipment: photo and electro colorimeter (PhEC), membrane filter, conical flasks, distilled water.

Work performance:

- a. the researched water is filtered through the membrane filter;
- b. 5-10 ml is poured in the dish and seen with dark blue lightfilter;
- c. chromaticity of test is estimated on the diagram.

The control is distilled water.

*Hygienic estimation.*

Chromaticity should not exceed  $20^0$  for the centralized sources and  $30^0$  - for decentralized.

***Determination of water turbidity.***

Equipment: PhEC, chemical glasses, distilled water.

Work performance:

- a. the researched water is well shook up;
- b. 5-10 ml is poured in the dish and seen with green lightfilter.

The control is distilled water.

*Hygienic estimation.*

Turbidity should not exceed  $1.5 \text{ mg/dm}^3$  for the centralized sources and  $2 \text{ mg/dm}^3$  - for decentralized.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

In the settlement air temperature is  $+29^{\circ}\text{C}$ , relative humidity is 80 %, speed of air movement is 0.1 m/s, atmospheric pressure is 730 mm hg. Estimate the physical factors of atmospheric air and offer actions for

the prevention of their adverse influence on a person.

*The algorithm of task's solution:*

The physical parameters of atmospheric air mismatch hygienic requirements: air temperature in the settlement exceeds optimum (optimum is 20°C), relative humidity is also above optimum (optimum is 50 %), speed of air movement is considerably below optimum (optimum is 2.5 m/s), atmospheric pressure is below optimum (optimum is 760 mm hg). The combination of high temperature, high relative humidity and low speed of air movement can lead to a hyperthermia, low level of atmospheric pressure leads to decrease of partial tension of oxygen in blood and to occurrence of pains in heart, joints etc.

It is possible to stop an adverse influence of microclimate by the usage of rational clothes, balanced diet and drinking mode, usage of green tea, optimization of modes of work and rest.

**1.** In the city air temperature is + 27°C, relative humidity is 76 %, speed of air movement is 0.2 m/s, atmospheric pressure is 733 mm hg. Estimate the physical factors of atmospheric air and offer actions for the prevention of their adverse influence on a person.

**2.** In the city air temperature is +26°C, relative humidity is 60 % and speed of air movement is 2.5 m/s. Estimate the physical factors of atmospheric air and offer actions for the prevention of their adverse influence on a person.

**3.** In the city air temperature is +30°C, relative humidity is 80 %, speed of air movement is 0.7 m/s. Estimate the physical factors of atmospheric air and offer actions for the prevention of their adverse influence on a person.

**4.** In the atmospheric air daily average concentration of nitrogen oxide is 0.15 mg/m<sup>3</sup>, sulphurous gas is 5 mg/m<sup>3</sup>. Estimate the ecological conditions of atmospheric air and offer optimization actions.

**5.** In air of the city daily average concentration of nitrogen dioxide is 0.2 mg/m<sup>3</sup> and nitrogen oxide is 0.25 mg/m<sup>3</sup>. Estimate the ecological conditions of atmospheric air and offer optimization actions.

**6.** In atmospheric air of the city maximum single concentration of carbonic oxide is 10 mg/m<sup>3</sup>, nitrogen dioxide is 4 mg/m<sup>3</sup>. Estimate the ecological conditions of atmospheric air and offer optimization actions.

**7.** Water in the artesian chink (1 class) has 30° of color, 3 mg/dm<sup>3</sup> of turbidity, 1006 microbe number, 4 coli-index, 450 mg/dm<sup>3</sup> of chlorides, 480 mg/dm<sup>3</sup> of sulfates. Estimate the source of water supply and offer actions of water quality improvement and protection from pollution.

**8.** Water in the river (water source of the 2 class) has 4 points smell, 35° of color; 2.5 mg/dm<sup>3</sup> of turbidity, 12 coli-index. Estimate the source of water supply and offer actions of water quality improvement and protection from pollution.

**9.** In ground of the city 15 mg/kg of formaldehyde, 160 mg/kg of nitrates are revealed. Estimate the condition of ground and offer improvement actions.

**10.** In ground of the city content of nitrates is 120 mg/kg, arsenic is 2 mg/kg, helminthes eggs is 150 per kg of ground. Estimate the ground condition and offer actions on its improvement.

**The literature.**

1. Lecture № 2.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P.17-27.

**Laboratory classes № 3.****The topic: HYGIENIC VALUE OF ENVIRONMENT POLLUTION**

*The theme has great value for further training at clinical department, in practical work of a doctor for hygienic diagnostic.*

**Aim of the Lesson:** to be able to assess environment pollutants and to propose actions for prevention of their adverse influence on health.

**Checking Questions.**

- ✓ 1. Environmental pollution and its hygienic value. Medical problems of pollution.
- ✓ 2. Hygienic value of air pollution.
- ✓ 3. Hygienic value of water pollution.
- ✓ 4. Hygienic value of soil pollution.
- ✓ 5. Prevention of adverse influence of environment pollution on health. Environmental protection from pollution.
- ✓ 6. Methods of studying and estimation of environment pollutants.

**Multiple Choice Questions.****Choose proper answers**

1. Sources of water pollution are:
  - 1) household objects;
  - 2) industrial enterprises;
  - 3) municipal objects;
  - 4) agriculture enterprises;
  - 5) sailing charter.
2. Biological pollution of water can cause at a person:
  - 1) intestinal infections;
  - 2) virus diseases;
  - 3) anthroozoonosis;
  - 4) protozoonosis;
  - 5) civilization illnesses.
3. Prevention of endemic diseases includes:
  - 1) addition of the necessary elements to water;
  - 2) addition of the necessary elements in food;
  - 3) usage of vitamin and mineral additives;
  - 4) processing of waters with the purpose of removal of surplus of microcells;
  - 5) fluorination of waters.

- 4.** Methods of water quality improvement are:
  - 1) treating;
  - 2) cleaning;
  - 3) disinfecting;
  - 4) purification;
  - 5) special methods of processing.
- 5.** Environmental contamination is a risk factor:
  - 1) infringement of bodies and systems functions;
  - 2) occurrence of acute and chronic poisonings;
  - 3) disease increase;
  - 4) development of the remote consequences;
  - 5) high state of health.
- 6.** Forms of pollution are:
  - 1) air pollution;
  - 2) littering;
  - 3) car pollution;
  - 4) noise pollution;
  - 5) body pollution.
- 7.** A pollutant is a waste material that pollutes:
  - 1) air;
  - 2) dwellings;
  - 3) water;
  - 4) hospitals;
  - 5) soil.
- 8.** Pollutants on origin are classified into:
  - 1) chemical nature;
  - 2) mechanical nature;
  - 3) physical nature;
  - 4) biological nature;
  - 5) physiological nature.
- 9.** Sources of pollution of natural origin are:
  - 1) space dust;
  - 2) fires;
  - 3) weakness;
  - 4) soil dust;
  - 5) pressure fall.
- 10.** Sources of pollution of anthropogenous origin are:
  - 1) industrial enterprises;
  - 2) household objects;



- 3) evaporations from water;
  - 4) agricultural enterprises;
  - 5) volcanic.
- 11.** Atmospheres pollutants of chemical nature are:
- 1) carbonic gas;
  - 2) solar radiation;
  - 3) nitrogen;
  - 4) ionising radiation;
  - 5) ammonia.
- 12.** Protection actions from pollution are:
- 1) technical;
  - 2) sanitary;
  - 3) legislative;
  - 4) organizational;
  - 5) treatment and preventive.
- 13.** Sources of water pollution are:
- 1) household objects;
  - 2) industrial enterprises;
  - 3) municipal objects;
  - 4) agriculture enterprises;
  - 5) sailing charter.
- 14.** Biological pollution of water can cause at a person:
- 1) intestinal infections;
  - 2) virus diseases;
  - 3) anthroozoonosis;
  - 4) protozoonosis;
  - 5) illnesses of a civilization.
- 15.** Biogeochemical provinces are:
- 1) areas where insufficient content of variety of chemical elements in soil or water is marked;
  - 2) areas where superfluous content of variety of chemical elements in soil or water is marked;
  - 3) biogeochemical endemias;
  - 4) areas where metabolism infringements are revealed;
  - 5) areas where endemic goiter is marked.

### **Laboratory Work.**

- 1. Determine the nitrites content in water, methemoglobin in blood and interrelation between them.

- 2. Estimate the received results.
- 3. Offer actions for prevention of adverse influence of water chemical factors on health.
- 4. Record the laboratory work report.

### ***Determination of nitrites content in water.***

Equipment: Photo and electro colorimeter (PhEC) (figure 3), test tubes, pipettes, conical flasks.

Reactants: Greese reactant, distilled water.

#### Work performance:

- a. 10 ml of the investigated water is taken;
- b. 0.5 ml of Greese reactant is added;
- c. measurement of solution's optical density with green optical filter №6 of PhEC is spent in 10 min. The control is distilled water.
- d. nitrites content in the investigated water is determined by the calibrating graph.



**Figure 3.** Photo and electro colorimeter.

#### *Hygienic estimation.*

Nitrites content in water should be no more than  $3.3 \text{ mg/dm}^3$ .

#### ***Determination of interrelation between nitrites contents and methemoglobinemia.***

The nitrites contents and methemoglobinemia is defined on the correlation factor. To calculate the correlation factor of Pirson's the following formula is used:

$$r = \frac{\sum(d_x \cdot d_y)}{\sqrt{\sum d_x^2 \cdot \sum d_y^2}}$$

where x and y – are signs between which correlation is defined;  
 $d_x$  and  $d_y$  – are deviations of everyone variant from the average size calculated among the signs x and y;  
 $\Sigma$  – is a sign sum.

### *Hygienic estimation.*

Estimation of adverse influence of nitrites in water on health is made by revealing of character of correlation between nitrites content in water and methemoglobinemia signs.

Force of correlation / Character of correlation	direct (+)	inverse (-)
Full	+1	-1
Strong	+1 ... +0,7	-1 ... -0,7
Average	+0,7 ... +0,3	-0,7 ... -0,3
Weak	+0,3 ... 0	-0,3 ... 0
No	0	0

### **Solve a problem, estimate the obtained data and request actions for their improvement**

#### **Situational Task.**

In atmospheric air of the city concentration of carbon oxide is 7 mg/m<sup>3</sup>, inorganic dust containing 75 % of silicon dioxide is 0.25 mg/m<sup>3</sup>. Estimate the air environment and offer actions for protection of atmospheric air from pollution.

#### *The algorithm of task's solution:*

The atmospheric air mismatches hygienic requirements: concentration of carbon oxide (MPC is 5 mg/m<sup>3</sup>) and concentration of inorganic dust (MPC is 0.15 mg/m<sup>3</sup>) are higher than MPC.

For protection of air environment it is necessary to use the following actions: technological - introduce of closed technological processes and clearing of raw materials of impurity; planning - inhabited zones should be projected far from an industrial zone taking into account wind rose, improve gardening of sanitary-protective zones of enterprises and inhabited zones; sanitary-engineering - adjust clearing of emissions in atmosphere by filters, cyclones; organizational - enterprises should make emissions into atmosphere at various time of day, perform monitoring, organize prophy-

lactic and medical examinations of persons which are influenced by the polluted air.

**1.** In atmospheric air of the city concentration of sulphurous gas is  $3 \text{ mg/m}^3$ , nitrogen oxide is  $0.1 \text{ mg/m}^3$ . Estimate the air environment and offer actions for protection of atmospheric air from pollution.

**2.** In atmospheric air of the city concentration of nitrogen oxide is  $0.3 \text{ mg/m}^3$ , nitrogen dioxide is  $0.1 \text{ mg/m}^3$ . Estimate the air environment and offer actions for protection of atmospheric air from pollution.

**3.** In atmospheric air of the city concentration of sulphurous gas is  $0.3 \text{ mg/m}^3$ , nitrogen oxide is  $0.1 \text{ mg/m}^3$ , nitrogen dioxide is  $0.2 \text{ mg/m}^3$ . Estimate the air environment and offer actions for protection of atmospheric air from pollution.

**4.** The river water (superficial source of the 1 class) contents 5 points taste and smell,  $50^\circ$  of coloring,  $10 \text{ mg/dm}^3$  of turbidity,  $600 \text{ mg/dm}^3$  of chlorides,  $610 \text{ mg/dm}^3$  of sulphates,  $75 \text{ mg/dm}^3$  of nitrates,  $0.5 \text{ mg/dm}^3$  of ammonia,  $500 \text{ CFU/dm}^3$  of E. coli. Estimate the water environment and offer actions for protection from pollution.

**5.** The river water (superficial source of the 1 class) contents 4 points taste and smell,  $40^\circ$  of coloring,  $5 \text{ mg/dm}^3$  of turbidity,  $400 \text{ mg/dm}^3$  of chlorides,  $600 \text{ mg/dm}^3$  of sulphates,  $45 \text{ mg/dm}^3$  of nitrates,  $0.01 \text{ mg/dm}^3$  of ammonia,  $100 \text{ CFU/dm}^3$  of E. coli. Estimate the water environment and offer actions for protection from pollution.

**6.** The artesian water (underground source of the 1 class) contents 3 points taste and smell,  $30^\circ$  of coloring,  $6 \text{ mg/dm}^3$  of turbidity,  $640 \text{ mg/dm}^3$  of chlorides,  $810 \text{ mg/dm}^3$  of sulphates,  $55 \text{ mg/dm}^3$  of nitrates,  $0.05 \text{ mg/dm}^3$  of ammonia,  $200 \text{ CFU/dm}^3$  of E. coli. Estimate the water environment and offer actions for protection from pollution.

**7.** The river water (superficial source of the 2 class) has  $40^\circ$  of coloring,  $30 \text{ mg/dm}^3$  of turbidity,  $0.3 \text{ mg/dm}^3$  of iron,  $0.2 \text{ mg/dm}^3$  of manganese,  $9 \text{ mg/dm}^3$  of oxidability. Estimate the water environment and offer actions for protection from pollution.

**8.** In the city soil it is revealed  $6 \text{ mg/kg}$  of arsenic, 120 helminthes eggs per kg of ground. Estimate the soil environment and offer actions for protection from pollution.

**9.** In the city soil it is revealed  $4 \text{ mg/kg}$  of arsenic, 94 helminthes eggs per kg of ground. Estimate the soil environment and offer actions for protection from pollution.

**10.** In the city soil it is revealed  $9 \text{ mg/kg}$  of formaldehyde,  $6 \text{ mg/kg}$

of arsenic, 10 helminthes eggs per kg of ground. Estimate the soil environment and offer actions for protection from pollution.

**The literature.**

1. Lecture № 2.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 27-33.

**Laboratory classes № 4.****The topic: HYGIENIC CHARACTERISTIC OF POPULATED AREAS**

*The theme has great value for further training at clinical departments, in practical work of a doctor for the effective improvement of population health and prevention of diseases.*

**Aim of the Lesson:** to be able to assess the city planning and placing and to propose preventive actions.

**Checking Questions.**

- ✓ 1. Planning of populated areas recently.
- ✓ 2. Urbanization and its hygienic value. Ecological and medical problems of populated areas pollution.
- ✓ 3. Hygienic requirements to choice of the territory for building of populated areas. Functional zoning of a city.
- ✓ 4. Hygienic requirements to planning and building of residential settlements and microdistricts.
- ✓ 5. Features of lay-out of rural populated areas.
- ✓ 6. Methods of studying and estimation of populated areas.

**Multiple Choice Questions.****Choose proper answers**

1. Adverse consequences of urbanization are:
  - 1) increase of chemical, physical, psychological and information loading on person;
  - 2) high population density, overpopulation;
  - 3) good conditions for people's health;
  - 4) insufficient housing;
  - 5) changes in all environmental components such as atmosphere, water, soil, flora, fauna, climate.
2. Air pollution in a city leads to:
  - 1) decrease of air transparency;
  - 2) active growing of green plantings;
  - 3) reduction of natural illumination;
  - 4) fog increase;
  - 5) formation of «toxic fogs».
3. Requirements to choice of territory for building of populated area:

- 1) territory should not be swamped and flooded by rivers, lakes, rain and melt waters;
  - 2) area should be dry, sandy or sabulous, pure, safe;
  - 3) the proper level of subsoil waters is 1.0 m from earth surface and 0.3 m and more from foundation base;
  - 4) the proper level of subsoil waters is 1.5 m from earth surface and 0.5 m and more from foundation base;
  - 5) far from sources of noise and environmental contamination, railways, airports, high-speed highways.
- 4.** Groups of populated areas depending on a population:
- 1) small;
  - 2) largest;
  - 3) large;
  - 4) big;
  - 5) average.
- 5.** City-formation factors are:
- 1) industrial and agricultural enterprises;
  - 2) warehouses and bases of logistics;
  - 3) enterprise and establishment of external transport;
  - 4) construction organizations;
  - 5) research and cultural establishments.
- 6.** A city population groups are:
- 1) city-formation;
  - 2) usefull;
  - 3) serving;
  - 4) industrial;
  - 5) not amateur.
- 7.** It is forbidden to build a city on the area of:
- 1) forest;
  - 2) dump;
  - 3) cemetery;
  - 4) burial ground for animal refuse;
  - 5) sanitary disposal field.
- 8.** Functional zones of city territory are:
- 1) residential;
  - 2) industrial;
  - 3) landscape recreational;
  - 4) administrative;
  - 5) green.

9. Hygienic value of green plantings for populated area:
  - 1) reduce dust content of air and reduce its gassed condition;
  - 2) improve microclimate of territories and premises;
  - 3) enrich air with oxygen;
  - 4) render phytoncidal and wind shelter action;
  - 5) reduce noise.
10. A microdistrict includes:
  - 1) residential buildings;
  - 2) preschool centers, schools;
  - 3) drugstores;
  - 4) green area with platforms for populations' rest, employment by physical culture and sports;
  - 5) garages and parking for individual transport.
11. Systems of microdistrict built-up are:
  - 1) continuous;
  - 2) closed;
  - 3) ordinary;
  - 4) complex;
  - 5) line.
12. Features of planning and building of village places are:
  - 1) building density should not exceed 5-6 %;
  - 2) should be placed near the highway;
  - 3) population 20-25 persons on 1 hectare (400-500 m<sup>2</sup> for 1 person);
  - 4) area for village building is chosen on plane, not flood territory, on sandy or loamy soil;
  - 5) area should not be crossed with highway or railroad track.
13. Functional zones of village are:
  - 1) inhabited;
  - 2) usefull;
  - 3) green;
  - 4) industrial;
  - 5) landscape.
14. Sanitary-protective zone in village is:
  - 1) 100-300 m;
  - 2) 500-1000 m;
  - 3) 50-1000 m;
  - 4) 10-30 m;
  - 5) 1000-5000 m.
15. Specificity of planning and accomplishment of villages is:



- 1) presence of private plots and premises for cattle and bird;
- 2) low-rise buildings;
- 3) compact building facilitates;
- 4) absence of waterpipe, water drain, central heating, gasification;
- 5) favorable condition of air environment.

### **Laboratory Work.**

- 1. Lead examination of the city's general plan.
- 2. Estimate the received results.
- 3. Offer actions for improvement.
- 4. Record the laboratory work report.

### ***Hygienic examination of city's general plan.***

Equipment: general plan of the city (figure 4), ruler, microcalculator.

Work performance:

- a. the following items are found out from general plan of the city:
  - the area of the city territory,
  - sufficiency of the city territory for residents;
  - gardening degree;
  - city zones (presence of residential, industrial, landscape-recreational and green zones);
  - sufficiency of sanitary-protective zones between industrial enterprises and residential zone;
  - distance from railway lines, road network;
  - planning of residential zone (presence and building of microdistricts, quarters, gardening, accomplishment).



**Figure 4.** General plan of Vitebsk.

*Hygienic estimation.*

The received results are compared with the requirements of SanNaR 2.07.01-89 «Town-planning. Planning and building of city and rural settlements».

**Solve a problem, estimate the obtained data and request actions for their improvement****Situational Task.**

The territory with sandy soil, 25° bias of the land lay, 1 m level of standing of subsoil waters, predominance of northeast wind was chosen for the settlement building. Upstream the river there is a large factory of the 1 class on the distance of 0.5 km. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

*The algorithm of task's solution:*

The bias of the land lay exceeds the proper one (normal is 10-20°), level of standing of subsoil waters is lower (normal is 1.5 m), predominance of wind is unfavorable. The large factory is situated upstream the river (should be downstream the river). Sanitary-protective zone of the enterprise of the 1 class is not sufficient (normal is 1000 m). The territory is not suitable for the settlement building.

It is necessary to choose the territory corresponding the hygienic requirements.

**1.** In the city there are residential, industrial and green zones. The size of the residential zone is 9 m<sup>2</sup> per 1 person. In the industrial zone the enterprise of the 1 class is constructed. The distance from the enterprise to the residential zone is 950 m. Sanitary-protective zone is planted with trees and shrubs on 38 %. Estimate the zoning of the city territory and offer actions for its improvement.

**2.** The territory with sandy soil, 25° bias of land lay, 1 m level of standing of subsoil waters, predominance of northeast wind was chosen for the settlement building. Upstream the river there is a large factory of the 1 class on the distance of 5 km. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

**3.** The territory with sandy soil, 20° bias of the land lay, 0,5 m level of standing of subsoil waters, predominance of north wind, without green massive was chosen for the settlement building. Taking into account the lay of land freshet and rain waters of the river comes the planned settlement territory. Estimate the territory of planned settlement and offer ac-

tions for a rational choice of territory.

**4.** The territory with clay soil, 5° bias of the land lay, 1 m level of standing of subsoil waters, predominance of north wind, without green massive was chosen for the settlement building. Taking into account the lay of land freshet and rain waters of the river comes the planned settlement territory. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

**5.** The territory with sandy soil, 25° bias of the land lay, 1,5 m level of standing of subsoil waters, predominance of northwest wind, without green massive was chosen for the settlement building. Upstream the river there is a large factory of the 2 class on the distance of 2 km. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

**6.** The territory with sandy soil, 2° bias of the land lay, 2 m level of standing of subsoil waters, predominance of north wind, without green massive was chosen for the settlement building. Upstream the river there is a large factory of the 3 class on the distance of 2,5 km. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

**7.** In the city there are residential, industrial and green zones. The size of the residential zone is 5 m<sup>2</sup> per 1 person. In the industrial zone the enterprise of the 1 class is constructed. The distance from the enterprise to the residential zone is 500 m. Sanitary-protective zone is planted with trees and shrubs on 20 %. Estimate the zoning of the city territory and offer actions for its improvement

**8.** The territory with sandy soil, 2° bias of the land lay, 3,5 m level of standing of subsoil waters, predominance of northwest wind, without green massive was chosen for construction of the city territory. Upstream the river there is a large factory of the 3 class on the distance of 200 m. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

**9.** The territory with sandy soil, 30° bias of the land lay, 3,5 m level of standing of subsoil waters, predominance of northwest wind, without green massive was chosen for construction of the city territory. Taking into account the lay of land freshet and rain waters of the river comes the planned settlement territory. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

**10.** The territory with clay soil, 10° bias of the land lay, 2 m level of standing of subsoil waters, predominance of north wind was chosen for construction of the rural settlement. The planned density of building is 15

%, population is 50 persons per 1 hectare. The sanitary-protective zone between inhabited and industrial zones makes 50 m. Close to the residential zone the repair shops and poultry-farming farm are planned. Estimate the territory of planned settlement and offer actions for a rational choice of territory.

**The literature.**

1. Lecture № 3.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 33-41.

### **Laboratory classes № 5.**

#### **The topic: HYGIENIC CHARACTERISTIC OF DWELLING**

*The theme has great value for further training at clinical department, in practical work of a doctor for the effective improvement of population health and prevention of diseases.*

**Aim of the Lesson:** to be able to assess the living conditions and to propose actions for prevention of their adverse influence on health.

#### **Checking Questions.**

- ✓ 1. Hygienic requirements to choice of the ground area for building of dwelling and building materials.
- ✓ 2. Hygienic requirements to internal planning of dwelling.
- ✓ 3. Hygienic requirements to sanitary-technical accomplishment, equipment and maintenance of dwelling. Ecological-medical value of internal environment of dwelling.
- ✓ 4. Hygienic requirements to microclimate of dwelling. The prevention of overheat and dampness in dwelling.
- ✓ 5. Features of planning, sanitary-technical accomplishment, equipment and maintenance of hostels.
- ✓ 6. Methods of studying and estimation of dwelling.

#### **Multiple Choice Questions.**

##### **Choose proper answers**

1. The hygienic requirements to dwelling are:
  - 1) providing of psychological and information loading on person;
  - 2) optimum microclimate;
  - 3) good conditions for smoke;
  - 4) favorable conditions for housekeeping, rest, dream, family, education of children;
  - 5) rational natural and artificial illumination.
2. The hygienic requirements to dwelling are:
  - 1) decrease of air transparency;
  - 2) favorable condition of the air environment;
  - 3) reduction of natural illumination;
  - 4) optimum microclimate;
  - 5) favorable spatial parameters.

3. Building of one-apartment one- and two-storeyed houses creates:
  - 1) good aeration;
  - 2) gases pollution;
  - 3) low population density;
  - 4) favorable microclimate;
  - 5) good insolation.
4. Hygienic requirements to territory of apartment houses:
  - 1) area of building is no more than 35 %;
  - 2) area of building is no more than 25 %;
  - 3) soil should be dry polluted;
  - 4) level of standing of subsoil waters is 1 m from earth surface or 0.2 m from foundation level;
  - 5) gardening is not less than 20-35 %.
5. An apartment structure is:
  - 1) subsidiary premises;
  - 2) archive;
  - 3) inhabited premises;
  - 4) department;
  - 5) open premises.
6. Inhabited premises of apartment includes:
  - 1) children's room;
  - 2) hall;
  - 3) bedroom;
  - 4) kitchen;
  - 5) office.
7. Subsidiary premises of apartment includes:
  - 1) dining room;
  - 2) kitchen;
  - 3) bathing;
  - 4) lobby-hall;
  - 5) office.
8. Opened premises of apartment includes:
  - 1) loggias;
  - 2) balconies;
  - 3) kitchen;
  - 4) lobby-hall;
  - 5) verandahs.
9. Sanitary-technical accomplishment of dwelling provides:
  - 1) water supply;

- 2) clearing from liquid and firm garbage;
  - 3) illumination;
  - 4) heating;
  - 5) ventilation.
- 10.** Indicators of natural illumination in apartment are:
- 1) light factor is  $1/7-1/8$ ;
  - 2) angle of light incidence is not less  $27^{\circ}$ ;
  - 3) angle of light incidence is not less  $17^{\circ}$ ;
  - 4) aperture corner is not less  $5^{\circ}$ ;
  - 5) factor of natural illumination is not less than 0.5 %.
- 11.** Indicators of air cleanliness in apartment are:
- 1) content of carbon dioxide is 0.05 %;
  - 2) oxidability of air is  $4 \text{ mg/m}^3$ ;
  - 3) general microbic dissemination is  $2000 \text{ CFU/m}^3$ ;
  - 4) housing smells;
  - 5) content of hemolytic streptococci is  $10 \text{ CFU/m}^3$ .
- 12.** Indicators of dwelling microclimate are:
- 1) temperature is  $18-24^{\circ}$ ;
  - 2) oxidability of air is  $4 \text{ mg/m}^3$ ;
  - 3) relative humidity is 30-60 %;
  - 4) speed of air movement is no more than 0.3 m/s;
  - 5) content of hemolytic streptococci is  $10 \text{ CFU/m}^3$ .
- 13.** Dwelling microclimate must be:
- 1) overheat;
  - 2) overcold;
  - 3) comfortable;
  - 4) uncomfortable;
  - 5) optimum.
- 14.** Features of hostel's planning are:
- 1) big quantity of beds;
  - 2) presence of isolator (1 bed per 40 living persons);
  - 3) underestimated floor space per 1 person;
  - 4) presence of reading rooms, rooms of day stay and other premises of the general using;
  - 5) availability of wardrobe, kitchens, still-rooms, pantries for storage of personal things, lavatories, washing room.
- 15.** Parameters of living rooms of hostels are:
- 1) width – 2.2 m;
  - 2) height – 2.5 m;

- 3) depth - 6 m;
- 4) floor area - 6 m<sup>2</sup>;
- 5) exhaust ventilation for kitchens - 60-90 m<sup>3</sup>/h on 1 m<sup>2</sup> area.

### Laboratory Work.

- 1. Determine temperature regimen, cooling ability of air, equivalent effective temperature of dwelling.
- 2. Estimate the received results.
- 3. Offer actions for improvement of dwelling microclimate.
- 4. Record the laboratory work report.

### *Determination of temperature regimen.*

Equipment: electric thermometer (figure 5).

Work performance:

- a. thermometer is established in the investigated place;
- b. thermometer is switched on and readings from the screen of the measuring block are taken in 3 min on distance 0,1-1-1,5 m from floor, on 0,1 m from external and internal walls, in corners and in the centre of the premise;
- c. three readings are read in each point of the investigated place in 3-5 min and average temperature and temperature differences on a vertical and a horizontal are counted;
- d. thermometer is switched off after work.



**Figure 5.** Electric thermometer.

### *Hygienic estimation.*

Temperature during the cold and transitive periods of year must be 18-22°C, differences - 1-2.5°C on a vertical and a horizontal in dwelling.



***Determination of air cooling ability.***

Equipment: spherical catathermometer (figure 6), hotplate, conical flask with water.

Work performance:

a. the tank of spherical catathermometer is heated up in water at the temperature 70-80°C until spirit will not fill the half of top expansion of capillary;

b. the device is wiped and placed on a workplace in suspended condition;

c. the time while spirit column is falling from 38 to 35°C is noted on a stop watch;

d. the size of air cooling ability is calculated under the formula:

$$H = F / t,$$

where H - cooling ability of air, mkal/sm<sup>2</sup>s;

F - the device factor;

t – the time of the device cooling, s.



**Figure 6.** Spherical catathermometer.

***Hygienic estimation.***

Cooling ability of air must be 5.5 -7 mkal/sm<sup>2</sup>s in dwelling.

***Determination of equivalent effective temperature.***

Equipment: aspiration psychrometer (figure 7), spherical catathermometer, hotplate, nomogram, psychrometer pipette, conical flask with water.

Work performance:

- a. the rag on the damp thermometer of the aspiration psychrometer is moistened;
- b. clockwork is started;
- c. the device is suspended on stand in the investigated place;
- d. the readings of damp and dry thermometers are taken in 3-5 min;
- e. the cooling ability of air is determined;
- f. the following formula is used for determination of speed of air movement less than 1 m/s:

$$V = \{(H/Q - 0.2) / 0.4\}^2,$$

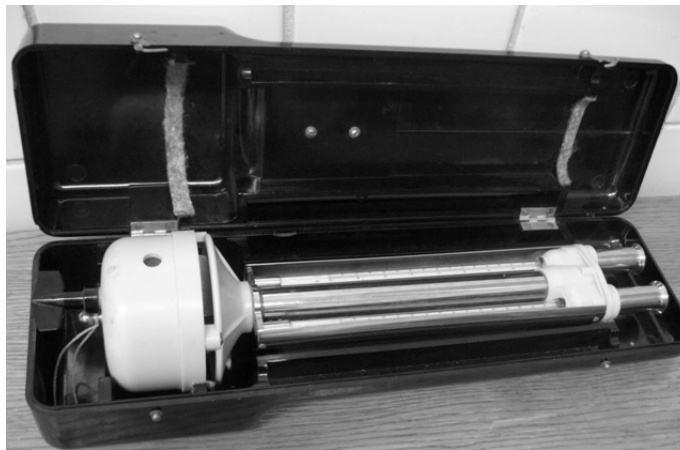
where V - speed of air, m/s;

H - cooling ability of air, mkal/sm<sup>2</sup>s;

Q - difference between average temperature of catathermometer (36.5<sup>0</sup>C) and air temperature;

0.2 and 0.4 - empirical factors.

- g. the point of crossing of dry temperature, damp temperature and speed of air movement is found at nomogram by means of ruler and EET is defined.



**Figure 7.** Aspiration psychrometer.

*Hygienic estimation.*

Equivalent effective temperature must be 17.2-21.7<sup>0</sup>C (it is the *comfort zone* which is marked at optimum health state of 50 % of people in the premise). EET 18.1-18.9<sup>0</sup> it is *comfort line* which is marked at optimum health state of all people in the premise.

## **Solve a problem, estimate the obtained data and request actions for their improvement**

### **Situational Task.**

In the living room of student's hostel on area of 20 m<sup>2</sup> 6 persons live. Factor of natural light exposure is 0.3 %, light factor is 1:10, combined artificial illumination by incandescent lamp is 60 lux, air temperature is 23<sup>o</sup>C, relative humidity is 80 %, speed of air movement is 0.6 m/s. Damp cleaning of the premise is made once per week. Estimate the residing conditions in the hostel and offer improvement actions.

*The algorithm of task's solution:*

The residing conditions in the hostel mismatch to hygienic requirements: the hostel living room is overpopulated (2-3 persons, 6 m<sup>2</sup> per one person must be in the living room), factor of natural light exposure is underestimated (normal is 0,5 %), light factor is underestimated (normal is 1:8), combined artificial light exposure is underestimated (normal is 75 lux), air temperature is raised (normal is 18<sup>o</sup>C), relative humidity is raised (normal is 40-60 %), speed of air movement is raised (normal is 0,1-0,2 m/s). Damp cleaning is spent very seldom.

It is necessary to reduce the quantity of people living in the room, to improve natural and artificial illumination (due to increase of window apertures area, quantity and capacities of fixtures) to normalize the microclimate (due to rational system of heating).

**1.** There are the following parameters in the projected apartment house: 7 m<sup>2</sup> area per 1 person, 2.3 m height from floor to ceiling, 7 m depth of rooms, less than 7 m<sup>2</sup> area of premises. Bathrooms and toilets are placed over living rooms and kitchens. Estimate the apartment's planning and offer improving actions.

**2.** There are the following parameters in the projected apartment house: 1:10 light factor, 2 % natural illumination factor, 20<sup>o</sup> angle of light incidence, 2<sup>o</sup> aperture angle. Estimate the illumination and offer actions for its improvement.

**3.** There are the following parameters in the projected apartment house: 1:12 light factor, 0.3 % natural illumination factor, 25<sup>o</sup> angle of light incidence, 2<sup>o</sup> aperture angle. Estimate the illumination and offer actions for its improvement.

4. The territory with 2 m level of standing of subsoil waters, 50 % building area, 10 % gardening area was chosen for apartment house's building. Sound insulation between rooms makes 30 dB, kitchen is connected by the general corridor to the living room. Estimate the placing and planning of the apartment house.

5. There are the following parameters in the dwelling: 28°C air temperature, 75 % relative humidity, 0.4 m/s speed of air movement, 4 mkalsm<sup>2</sup>/s cooling ability of air. Estimate the dwelling microclimate and offer improvement actions.

6. In the living room of student's hostel for area of 18 m<sup>2</sup> 4 students live. Hostel living rooms are grouped. There is a kitchen and rooms for employment and rest. The area of premise for employment is 0.15 m<sup>2</sup> per 1 person, factor of natural light exposure is 1 %, light factor is 1:7, artificial light exposure is 80 lux. Estimate the residing conditions in the hostel and offer improvement actions.

7. In the living room of worker's hostel for area of 15 m<sup>2</sup> 3 workers live. Hostel living rooms are grouped. Each group of rooms is adjoined by the lavatory, there is a kitchen. Rooms for employment and rest are not organized. Air temperature is 16°C, relative humidity is 75 %, speed of air movement is 0.1 m/s in premises. Estimate the residing conditions in the hostel and offer improvement actions.

8. The student's hostel for 200 persons is located on the 3000 m<sup>2</sup> ground area. Territory is not arranged well and not planted with trees and shrubs. In the living room on area of 18 m<sup>2</sup> 3 students live. Estimate the residing conditions in the hostel and offer improvement actions.

9. In the living room of student's hostel for area of 25 m<sup>2</sup> 5 students live. Hostel living rooms are not grouped. There are lavatories (lavatories, shower and washstands) and rooms for employment. The area of premise for employment is 0.3 m<sup>2</sup> per 1 student. Estimate the residing conditions in the hostel and offer improvement.

10. The area of hostel's living room is 5 m<sup>2</sup> per 1 person, in the room 5 students live. There is a bathroom (toilet, shower). The kitchen is separately from the room. Estimate the residing conditions and offer improvement actions.

### **The literature.**

1. Lecture № 3.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P.41-46.

**Laboratory classes № 6.**  
**The topic: HYGIENIC CHARACTERISTIC  
OF BALANCED DIET**

*The theme has great value for further training at clinical departments, in practical work of a doctor for prevention of malnutrition.*

**Aim of the Lesson:** to be able to assess nutritional status and to propose actions for its optimization.

**Checking Questions.**

- ✓ 1. Hygienic value of nutrition. Hygiene of nutrition.
- ✓ 2. Interrelation of foodstuffs and pharmaceutical drugs.
- ✓ 3. Balanced diet laws.
- ✓ 4. Features of nutrition recently. Nutrition in adverse ecological conditions.
- ✓ 5. Hygienic characteristic of food status.
- ✓ 6. Methods of studying and estimation of food status.

**Multiple Choice Questions.**

**Choose proper answers**

1. Features of modern nutrition are:
  - 1) thermal processing of food;
  - 2) clearing of nutrients;
  - 3) mixture of animal and vegetative food;
  - 4) presence of spices and artificial additives in food;
  - 5) using of crude meat.
2. Balanced diet laws are:
  - 1) the law of food adequacy;
  - 2) the law of food equation;
  - 3) the law of food safety;
  - 4) the law of food understanding;
  - 5) the law of food value.
3. Consequences of refined products usage are:
  - 1) fall of thyroid gland and adrenal glands functions;
  - 2) provision of contraction of muscles including cardiac muscle;
  - 3) disease of metabolism;
  - 4) cardiovascular, digestive, nervous diseases;

- 5) overconsumption of the cleared sugar leads to asthenia, depressions, obesity.
- 4.** Features of thermally processed food:
- 1) food structure is broken;
  - 2) proteins, vitamins and enzymes are destroyed;
  - 3) provision of substance for the replacement of dead tissue;
  - 4) mineral substances are washed away;
  - 5) bactericidal and antiinflammatory properties of food are lost.
- 5.** The law of food adequacy includes:
- 1) power adequacy;
  - 2) mental adequacy;
  - 3) enzymatic adequacy;
  - 4) biorhythmic adequacy;
  - 5) plastic adequacy.
- 6.** The main types of food status are:
- 1) optimum;
  - 2) artificial;
  - 3) average;
  - 4) superfluous;
  - 5) insufficient.
- 7.** Foods are classified according to their functions:
- 1) protective;
  - 2) dietetic;
  - 3) energy producing;
  - 4) perfect;
  - 5) body building.
- 8.** Classification of nutraceuticals are:
- 1) perfect foods;
  - 2) dietary supplements;
  - 3) medical foods;
  - 4) functional foods;
  - 5) farmaceuticals.
- 9.** Food additives are the legally permitted substances added to food to improve its:
- 1) appearance;
  - 2) flavor;
  - 3) colour;
  - 4) nutritive value;

5) storage property.

**10. Types of nutrition are:**

- 1) balanced;
- 2) combined;
- 3) artificial;
- 4) preventive;
- 5) therapeutic.

**11. Preventive nutrition:**

- 1) is aimed for occupational diseases prevention;
- 2) is intended for people at risk in order to prevent non-specific nature of the disease;
- 3) is intended for healthy people and aimed for nutrition-related diseases prevention;
- 4) is satisfied the energy and plastic human needs;
- 5) is intended for patients with chronic diseases.

**12. Types of insufficient food status are:**

- 1) insufficient defective;
- 2) insufficient compensated;
- 3) insufficient premorbid;
- 4) insufficient morbid;
- 5) insufficient subcompensated.

**13. Optimum status is formed at:**

- 1) most people with a balanced diet;
- 2) people with favorable heredity;
- 3) people who observe the rules of healthy lifestyle;
- 4) under the influence of special diets in certain professions;
- 5) people with excess body weight.

**14. Methods for determination of energy expenditure of the body are:**

- 1) direct calorimetry;
- 2) indirect calorimetry;
- 3) nutritional calorimetry;
- 4) chronometer and table method;
- 5) analysis of the menu-layout.

**15. Medical nutrition:**

- 1) is aimed for occupational diseases prevention;
- 2) is intended for people at risk in order to prevent non-specific nature of the disease;
- 3) is intended for healthy people and aimed for nutrition-related diseases prevention;

- 4) is satisfied the energy and plastic human needs;
- 5) is intended for patients with chronic diseases.

### **Laboratory Work.**

- 1. Study food status of students.
- 2. Estimate the received results.
- 3. Offer actions for improvement of nutrition.
- 4. Record the laboratory work report.

#### *Determination of status of individual nutrition by Broke and Quetelet indexes.*

Equipment: height meter, medical scales, microcalculator.

Work performance:

a) individual height is measured by means of height meter:  
- at height measurement in standing pose a student stands, hands on seams, heels together, socks separately, thus he touches the heightmeter's racks with heels, buttocks and intrascapular area, the head is slightly inclined in such a way that a line from an tragus upper edge to a bottom edge of an eye-socket is at horizontal level, in parallel floor plane, heightmeter's ruler is lowered on a top point of a head;

b) individual weight is defined by means of medical scales: the student should be on empty stomach, without clothes and footwear, scales point is put on zero, the student stands on the middle of the scales platform, scales is counterbalanced with movable weights.

c) Broke index is counted under the formula:

$$\text{MHI} = \text{M} / (\text{H}-100),$$

where MHI - Broke index,

M - weight of body in kg,

H - height in cm.

d) Quetelet index (body-mass index) is counted under the formula:

$$\text{BMI} = \text{M} / (\text{H})^2,$$

where BMI - Quetelet index,

M - weight of body in kg,

H - height in m.

#### *Hygienic estimation.*

#### ***Broke index:***

0.9 – 1.1 is usual status of nutrition;

lower than 0.9 - insufficient;

more than 1.1 - superfluous.



**Quetelet index:**

- 18.5 - 25 is usual status;
- 16.0 - 18.5 is insufficient defective nutrition status (underweight);
- 15.0 - 16.0 is lack of premorbid nutritional status (severe underweight);
- less than 15 is insufficient morbid nutritional status (very severe underweight);
- 25 – 30 is overweight;
- 30 – 35 is excessive premorbid nutritional status (obese Class I, moderate obese);
- 35 – 40 is obese Class II (severe obese);
- over 40 is excess morbidity nutritional status (obese Class III, very severe obese).

**Solve a problem, estimate the obtained data and request actions for their improvement****Situational Task.**

A student of medical university, 20 years old with 170 cm height and 50 kg weight. Estimate the nutrition status and offer actions for its improvement.

*The algorithm of task's solution:*

The nutrition status of the student is insufficient:

Broke index =  $50: (170-100) = 0.7$  (usual is 0.9-1.1).

It is necessary to increase the daily intake of foodstuffs with high food value: meat, fish, eggs, dairy products, nuts, cereals, etc.

1. A surgeon, male, 28 years old with 170 cm and weight 85 kg. Estimate the nutrition status and offer actions for its improvement.

2. A medical student, male, 22 years old with height 180 cm and weight 88 kg. Estimate the nutrition status and offer actions for its improvement.

3. A nurse, 25 years old with height 165 cm and weight 75 kg. Estimate the nutrition status and offer actions for its improvement.

4. A worker, female, 30 years old with height 168 cm and weight 83 kg. Estimate the nutrition status and offer actions for its improvement.

5. A therapist, female, 25 years old with height 160 cm and weight 45 kg. Estimate the nutrition status and offer actions for its improvement.

6. A pedagogical student, female, with height 165 cm and weight 80 kg. Estimate the nutrition status and offer actions for its improvement.

7. A traumatologist, male, 30 years old with height 180 cm and weight 62 kg. Estimate the nutrition status and offer actions for its improvement.

8. A surgeon, mail, 30 years old with height 170 cm and weight 100 kg. Estimate the nutrition status and offer actions for its improvement.

9. An aid-woman, 23 years old with height 168 cm and weight 51 kg. Estimate the nutrition status and offer actions for its improvement.

10. A head of the polyclinic, female, 39 years old with height 175 cm and weight 88 kg. Estimate the nutrition status and offer actions for its improvement.

#### **The literature.**

1. Lecture № 4.

2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 47-51.

**Laboratory classes № 7.****The topic: HYGIENIC CHARACTERISTIC OF PROTEIN AND ENERGY VALUE OF NUTRITION**

*The theme has great value for further training at clinical departments, in practical work of a doctor for prevention of malnutrition.*

**Aim of the Lesson:** to be able to assess protein and energy full value of nutrition and to propose actions for its optimization.

**Checking Questions.**

- ✓ 1. Hygienic value of nutrients.
- ✓ 2. Norms of physiological requirement for nutrients and energy for various groups of adult population.
- ✓ 3. Hygienic characteristic of proteins. Illnesses of insufficient and superfluous proteins nutrition and their prevention.
- ✓ 4. Hygienic characteristic of fats. Illnesses of insufficient and superfluous fatty nutrition and their prevention.
- ✓ 5. Hygienic characteristic of carbohydrates. Illnesses of insufficient and superfluous carbohydrate nutrition and their prevention.
- ✓ 6. Methods of studying and estimation of protein and energy adequacy of nutrition.

**Multiple Choice Questions.****Choose proper answers**

1. There are following macronutrients:

- 1) vitamins;
- 2) proteins;
- 3) carbohydrates;
- 4) minerals;
- 5) fats.

2. They are following micronutrients:

- 1) vitamins;
- 2) proteins;
- 3) carbohydrates;
- 4) minerals;
- 5) fats.

3. Essential amino acids are:

- 1) isoleucine;



- 2) cysteine;
  - 3) methionine;
  - 4) valine;
  - 5) histidine.
4. Nonessential amino acids are:
- 1) asparagine;
  - 2) lysine;
  - 3) tryptophan;
  - 4) arginine;
  - 5) glycine.
5. Unsaturated fatty acids includes:
- 1) palmitic acid;
  - 2) linoleic acid;
  - 3) lauric acid;
  - 4) oleic acid;
  - 5) stearic acid.
6. Carbohydrates compounds can be classified in to:
- 1) monosaccharides;
  - 2) trisaccharides;
  - 3) disaccharides;
  - 4) polysaccharides;
  - 5) triphenylamine.
7. Person`s requirement in nutrients and energy depends on:
- 1) weight and intensity of labour process;
  - 2) daily power expenses;
  - 3) age;
  - 4) climate;
  - 5) sex.
8. Ratio between proteins, fats and carbohydrates in 18-29 and 30-39 years age groups is recommended:
- 1) 1:1.1:4.9 for men;
  - 2) 1.1:1:4.9 for men;
  - 3) 1.1:1:4.7 for women;
  - 4) 1:1.1:4.7 for women;
  - 5) 1:1.1:4.7 for men.
9. The 2nd group of work intensity is:
- 1) workers of mainly brainwork;
  - 2) workers perform easy physical work;
  - 3) workers perform work of average weight;



- 4) workers perform heavy physical work;
  - 5) workers perform especially heavy physical work.
10. The 4th group of work intensity is:
- 1) workers of mainly brainwork;
  - 2) workers perform easy physical work;
  - 3) workers perform work of average weight;
  - 4) workers perform heavy physical work;
  - 5) workers perform especially heavy physical work.
11. Malnutrition forms are:
- 1) undernutrition;
  - 2) overnutrition;
  - 3) nonspecific deficiency;
  - 4) imbalance;
  - 5) specific deficiency.
12. Preventive measures of malnutrition are:
- 1) addition of lack nutrients or restriction of some nutrients;
  - 2) rehabilitation of poor meal children;
  - 3) vitaminization of feed by preparations of vitamins;
  - 4) insolation;
  - 5) feed rationalization.
13. Deficiency of proteins can cause:
- 1) marasmus;
  - 2) edema;
  - 3) anaemia;
  - 4) cardiovascular diseases;
  - 5) kwashikor.
14. Excess of carbohydrates can cause:
- 1) diabetes mellitus;
  - 2) obesity;
  - 3) caries;
  - 4) vomiting;
  - 5) hyperglycemia.
15. Groups of work intensity for rationing of physiological requirement in food substances and energy of adult population:
- 1) workers with physical activity factor 1.4 (teachers, workers of a science, therapists, neuropathologists, pharmacists, secretaries);
  - 2) workers with physical activity factor 1.6 (clothing manufacturer, agriculturists, zootechnicians, veterinary surgeons, medical sisters, trainers);



- 3) workers with physical activity factor 1.9 (machine operators, chemists, surgeons, textile workers, drivers);
- 4) workers with physical activity factor 2.3 (machine operators, agricultural and building workers);
- 5) workers with physical activity factor 2.5 (colliers, first helper, fellers, navies).

### **Laboratory Work.**

- 1. Study protein and energy full value of students' nutrition.
- 2. Estimate the received results.
- 3. Offer actions for improvement of nutrition.
- 4. Record the laboratory work report.

### ***Determining of adequacy of nutrition according to menu (content of proteins, fats, carbohydrates and calories).***

Equipment: calculator, tables «Chemical structure and nutritional value of foodstuffs».

Work performance: On the basis of individual menu with usage of the tables content of proteins, fats, carbohydrates, ratio between them, energy consumed during day and week are calculated.

### ***Hygienic estimation.***

The daily diet of men 18-29 years old at 1.4 rate of physical activity must contain 72 g of protein, 81 g of fats, 358 g of carbohydrate and 2450 kcal of energy.

The daily diet of women 18-29 years old at 1.4 rate of physical activity must contain 61 g of protein, 67 g of fats, 269 g of carbohydrate and 2000 kcal of energy.

The recommended ratio of proteins : fats : carbohydrates is 1:1.1:4.9 for men and 1:1.1:4.7 - for women, quantity of food intake is 4 (breakfast - 25%, lunch - 35 %, five o'clock tea - 15%, dinner - 25%).

**Solve a problem, estimate the obtained data and request actions for their improvement**

### **Situational Task.**

A medical student (female) of 20 years old intakes 50 g of proteins, 65 g of fats, 260 g of carbohydrates per day. Estimate the nutrition ration



and offer actions for its improvement.

*The algorithm of task's solution:*

Nutrition of a student is not adequate: she consumes less proteins (normal is 61), fats (normal is 67), carbohydrates (normal is 269).

It is necessary to increase daily requirement in proteins on 11 g, fats - on 2 g, carbohydrates - on 29 g.

1. A surgeon, male, 28 years old intakes 100 g of proteins, 100 g of fats and 500 g of carbohydrates, 3000 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

2. A medical student (male), 22 years old intakes 90 g of proteins, 100 g of fats and 650 g of carbohydrates, 3200 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

3. A nurse, 25 years old intakes 68 g of proteins (30 g animal proteins), 90 g of fats and 400 g of carbohydrates, 3300 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

4. A surgeon, male, 38 years old intakes 150 g of proteins, 180 g of fats and 600 g of carbohydrates, 4000 kcal of energy per day. Estimate nutrition ration and offer actions for its improvement.

5. A medical student (female), 25 years old intakes 60 g of proteins, 45 g of fats and 200 g of carbohydrates, 1800 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

6. A medical student (male), 22 years old intakes 58 g of proteins, 67 g of fats and 250 g of carbohydrates, 2000 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

7. An aid-woman, 29 years old intakes 55 g of proteins, 85 g of fats and 380 g of carbohydrates, 1800 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

8. A pupil of technical school (female), 18 years old intakes 65 g of proteins, 70 g of fats and 300 g of carbohydrates, 1900 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

9. The pupil of technical school (male) of 19 years old intakes 60 g of proteins, 70 g of fats and 300 g of carbohydrates, 2000 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.

10. A therapist (female), 28 years old intakes 55 g of proteins, 59 g of fats and 200 g of carbohydrates, 1850 kcal of energy per day. Estimate the nutrition ration and offer actions for its improvement.



**The literature.**

1. Lecture № 4.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 51-52, 56-61.



**Laboratory classes № 8.**

**The topic: HYGIENIC CHARACTERISTIC OF  
VITAMIN AND MINERAL VALUE OF NUTRITION**

*The theme has great value for further training at clinical departments, in practical work of a doctor for prevention of malnutrition.*

**Aim of the Lesson:** to be able to assess vitamin and mineral full value of nutrition and to propose actions for its optimization.

**Checking Questions.**

- ✓ 1. Hygienic value of vitamins, mineral elements and water.
- ✓ 2. Norms of physiological requirement in vitamins and minerals for various groups of adult population.
- ✓ 3. Hygienic characteristic of vitamins. Illnesses of insufficient and superfluous vitamin nutrition and their prevention.
- ✓ 4. Hygienic characteristic of major elements and trace elements. Illnesses of insufficient and superfluous mineral nutrition and their prevention.
- ✓ 5. Hygienic characteristic of water.
- ✓ 6. Methods of studying and estimation of vitamin and mineral adequacy of nutrition.

**Multiple Choice Questions.**

**Choose proper answers**

1. Vitamins are classified into:
  - 1) fat soluble;
  - 2) vitamins B complex;
  - 3) macrovitamins;
  - 4) water soluble;
  - 5) microvitamins.
2. Fat soluble vitamins are:
  - 1) A;
  - 2) B<sub>1</sub>;
  - 3) E;
  - 4) D;
  - 5) PP.
3. Water soluble vitamins are:
  - 1) A;
  - 2) D;

- 3) K;
- 4) C;
- 5) B<sub>1</sub>;
- 4. Functions of vitamin A:**
  - 1) helps in the production of retinol pigments needed for vision in dim light;
  - 2) helpful to maintain the functioning and integrity of glandular and epithelial tissues;
  - 3) necessary for maintenance of walls strength of blood capillaries;
  - 4) helps in skeletal growth and has an anti-infective action;
  - 5) increases the resistance of the body against infection.
- 5. Functions of vitamin K:**
  - 1) role in oxidative reaction in tissues;
  - 2) necessary for maintenance of walls strength of blood capillaries;
  - 3) helps in the production of retinol pigments needed for vision in dim light;
  - 4) is required for development and maintenance of healthy bones and teeth;
  - 5) increases resistance of the body against infection;
- 6. Source of Vitamin D are:**
  - 1) egg yolk;
  - 2) milk;
  - 3) vegetable oils;
  - 4) bread;
  - 5) nuts.
- 7. Source of vitamin C are:**
  - 1) citrus fruits;
  - 2) milk;
  - 3) amla;
  - 4) green leafy vegetables;
  - 5) bread.
- 8. Major minerals are:**
  - 1) calcium;
  - 2) sodium;
  - 3) phosphorous;
  - 4) fluorine;
  - 5) cobalt.
- 9. Trace elements are:**
  - 1) potassium;

- 2) manganese;
- 3) zinc;
- 4) copper;
- 5) calcium.

**10.** Iron is required for:

- 1) formation of haemoglobin, RBC, myoglobin;
- 2) transport of oxygen and tissue oxidation;
- 3) brain development and muscle activity;
- 4) cell respiration;
- 5) metabolism of catecholamines.

**11.** Source of fluorine are:

- 1) sea fish;
- 2) meat;
- 3) milk;
- 4) drinking water;
- 5) butter.

**12.** Vitamin A deficiency can cause:

- 1) stunted growth;
- 2) night blindness;
- 3) cheilosis;
- 4) anaemia;
- 5) corneal xerosis.

**13.** Folic acid deficiency disease is:

- 1) glossitis;
- 2) angular stomatitis;
- 3) megaloblastic anaemia;
- 4) infertility or sterility;
- 5) convulsions.

**14.** Vitamin A excess can cause:

- 1) dizziness;
- 2) hair loss;
- 3) vomiting;
- 4) visual impairment;
- 5) spasms.

**15.** Zinc deficiency disease is:

- 1) pernicious anaemia;
- 2) disturbance of taste;
- 3) syndrome of nanism (microsomia);
- 4) sexual dysfunction;

5) alopecia.

### Laboratory Work.

- 1. Study vitamin and mineral full value of nutrition of students.
- 2. Estimate the received results.
- 3. Offer actions for improvement of nutrition.
- 4. Record the laboratory work report.

#### *Determining of adequacy of nutrition according to menu*

*(content of vitamins A, B<sub>1</sub>, C, calcium, phosphorus, magnesium, iron).*

Equipment: calculator, tables «Chemical structure and nutritional value of foodstuffs».

Work performance: On the basis of individual menu with usage of tables vitamins and minerals content consumed during day and week are calculated.

#### *Hygienic estimation.*

The daily diet of men of 18-29 years old at 1.4 rate of physical activity 1000 mg of calcium, 800 mg of phosphorus, 400 mg of magnesium, 10 mg of iron, 1.5 mg of vitamin B<sub>1</sub>, 900 mg of vitamin A, 90 mg of vitamin C must contain.

The daily diet of women of 18-29 years old at 1.4 rate of physical activity 1000 mg of calcium, 800 mg of phosphorus, 400 mg of magnesium, 18 mg of iron, 1.5 mg of vitamin B<sub>1</sub>, 900 mg of vitamin A, 90 mg of vitamin C must contain.

The recommended quantity of food intake is 4 (breakfast - 25%, lunch - 35 %, five o'clock tea - 15%, dinner - 25%).

**Solve a problem, estimate the obtained data and request actions for their improvement**

#### **Situational Task.**

A medical student (female), 22 years old intakes 1 mg of vitamin B<sub>1</sub>, 0.8 mg of vitamin B<sub>2</sub>, 0.5 mg of vitamin B<sub>6</sub>, 10 mg of vitamin PP, 60 g of vitamin C, 500 mg of calcium per day. Estimate the vitamin and mineral value and offer actions for its improvement.

*The algorithm of task's solution:*

Nutrition of the student is not adequate: she consumes less than re-

quired vitamin B<sub>1</sub> (normal is 1,1 mg), vitamin B<sub>2</sub> (normal is 1,3 mg), vitamin B<sub>6</sub> (normal is 1,8 mg), vitamin PP (normal is 14 mg), vitamin C (normal is 70 mg), calcium (normal is 800 mg).

It is necessary to increase the daily requirement of vitamins and minerals.

1. A worker, 30 years old intakes 2 mg of vitamin B<sub>1</sub>, 1.8 mg of vitamin B<sub>2</sub>, 1.5 mg of vitamin B<sub>6</sub>, 2.5 mg of vitamin B<sub>12</sub>, 15 mg of vitamin PP, 70 g of vitamin C, 500 mg of calcium per day. Estimate the vitamin and mineral value and offer actions for its improvement.

2. A nursing mother, 25 years old intakes 40 mg of vitamin C, 2 mg of vitamin B<sub>12</sub> per day. She mainly follows the vegetable diet excluding animal food. Estimate the food value of the nursing mother and offer actions for its improvement.

3. A pedagogical student (female) intakes 700 mg of calcium, 100 mg of phosphorus, 300 mg of magnesium, 65 mg of vitamin C, 1 mg of vitamin B<sub>1</sub>, 1,1 mg of vitamin B<sub>2</sub>, 1,5 mg of vitamin B<sub>6</sub>, 2 mg of vitamin B<sub>12</sub> per day. Estimate the vitamin and mineral value and offer actions for its improvement.

4. A traumatologist (male), 30 years old intakes 900 mg of calcium, 1300 mg of phosphorus, 600 mg of magnesium, 50 g of vitamin C, 1 mg of vitamin B<sub>1</sub>, 1 mg of vitamin B<sub>2</sub>, 1 mg of vitamin B<sub>6</sub>, 1 mg of vitamin B<sub>12</sub> per day. Estimate the vitamin and mineral value and offer actions for its improvement.

5. A surgeon (mail), 30 years old intakes 800 mg of calcium, 1200 mg of phosphorus, 500 mg of magnesium, 20 g of vitamin C, 1 mg of vitamin B<sub>1</sub>, 1 mg of vitamin B<sub>2</sub>, 1 mg of vitamin B<sub>6</sub>, 0.1 mg of vitamin B<sub>12</sub> per day. Estimate the vitamin and mineral value and offer actions for its improvement.

6. An aid-woman, 23 years old intakes 80 g of vitamin C, 3 mg of vitamin B<sub>1</sub>, 3 mg of vitamin B<sub>2</sub> per day. Estimate the vitamin and mineral value and offer actions for its improvement.

7. A nurse, 28 years old intakes 700 mg of calcium, 100 mg of phosphorus, 300 mg of magnesium, 35 g of vitamin C per day. Estimate the vitamin and mineral value and offer actions for its improvement.

8. A head of the polyclinic, 39 years old, intakes 900 mg of calcium, 300 mg of phosphorus, 100 mg of magnesium, 85 g of vitamin C per day. Estimate the vitamin and mineral value and offer actions for its improvement.

**9.** The student (female) of medical university of 23 years old intakes 500 mg of calcium, 200 mg of phosphorus, 100 mg of magnesium, 20 g of vitamin C per day. Estimate the vitamin and mineral value and offer actions for its improvement.

**10.** A teacher, 25 years old intakes 2 mg of vitamin B<sub>1</sub>, 1.5 mg of vitamin B<sub>2</sub>, 1.2 mg of vitamin B<sub>6</sub>, 2.5 mg of vitamin B<sub>12</sub>, 15 mg of vitamin PP, 70 g of vitamin C, 500 mg of calcium per day. Estimate the vitamin and mineral value and offer actions for its improvement.

**The literature.**

1. Lecture № 4.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 53-59.

**Laboratory classes № 9.**  
**The topic: HYGIENIC CHARACTERISTIC OF  
FOODSTUFFS**

*The theme has great value for further training at clinical departments, in practical work of a doctor.*

**Aim of the Lesson:** to be able to assess of foodstuffs high quality and to propose actions for its optimization.

**Checking Questions.**

- ✓ 1. Foodstuffs, their structure, value and efficiency.
- ✓ 2. Hygienic characteristic of meat, meat products and eggs, fish, fish products and other sea products.
- ✓ 3. Hygienic characteristic of milk and dairy products.
- ✓ 4. Hygienic characteristic of bakery and flour-and-cereals products.
- ✓ 5. Hygienic characteristic of vegetables, fruits, berries and products of their processing.
- ✓ 6. Methods of studying and estimation of food's quality.

**Multiple Choice Questions.**

**Choose proper answers**

1. Structure of foodstuffs is:
  - 1) nutrients;
  - 2) flavouring substances;
  - 3) supplemental substances;
  - 4) antinutrients;
  - 5) foreign substances or xenobiotics.
2. Value and efficiency of foodstuffs are:
  - 1) food value;
  - 2) energy efficiency;
  - 3) biological value;
  - 4) energy value;
  - 5) food efficiency.
3. Biological value of foodstuffs means:
  - 1) useful properties are characterized by the chemical compound;
  - 2) amino acids conformity to organism requirements;
  - 3) energy released from foodstuff;

- 4) content of unsaturated fatty acid;
  - 5) content of saturated fatty acid.
- 4.** Biological efficiency of foodstuffs means:
- 1) useful properties are characterized by the chemical compound;
  - 2) amino acids conformity to organism requirements;
  - 3) energy released from foodstuff;
  - 4) content of unsaturated fatty acid;
  - 5) content of saturated fatty acid.
- 5.** Foodstuffs groups are:
- 1) cereals;
  - 2) pulses;
  - 3) nuts and oilseed;
  - 4) vegetables fruits;
  - 5) milk and milk products.
- 6.** Rice contains:
- 1) protein;
  - 2) iron;
  - 3) phosphorus;
  - 4) vitamin A;
  - 5) vitamin C.
- 7.** Wheat is a good source of:
- 1) calcium;
  - 2) iron;
  - 3) phosphorus;
  - 4) thiamine;
  - 5) riboflavin.
- 8.** Soya beans content:
- 1) 43% proteins;
  - 2) 20% fats;
  - 3) 20% carbohydrates;
  - 4) 60% proteins;
  - 5) 80% proteins.
- 9.** Whole grains content:
- 1) thiamine;
  - 2) niacin;
  - 3) riboflavin;
  - 4) pyridoxine;
  - 5) proteins.
- 10.** Groundnuts content:



- 1) 27% proteins;
  - 2) 25% carbohydrates;
  - 3) 40% fats;
  - 4) 2% minerals;
  - 5) thiamine, niacin, riboflavin.
- 11.** Green Leafy Vegetables are:
- 1) fenugreek (menthi);
  - 2) mint (pudina);
  - 3) spinach (palak);
  - 4) coriander (kothmir);
  - 5) amaranth (raj girha).
- 12.** Green Leafy Vegetables are good source of:
- 1) calcium, iron, sodium, chlorides;
  - 2) ascorbic acid, thiamine, riboflavin;
  - 3) folates fenugreek (menthi);
  - 4) vitamin A;
  - 5) beta-carotene.
- 13.** Fruits are good source of:
- 1) iron;
  - 2) potassium;
  - 3) calcium;
  - 4) sodium;
  - 5) ascorbic acid, thiamine, beta-carotene.
- 14.** Meat contents:
- 1) 18-22% proteins;
  - 2) 10-20% fats;
  - 3) 1,5% minerals;
  - 4) 20 % carbohydrates;
  - 5) 25 % vitamins.
- 15.** Fish contents:
- 1) iron;
  - 2) manganese;
  - 3) calcium;
  - 4) phosphorus;
  - 5) iodine.

### Laboratory Work.

- 1. Study porosity and acidity of bread, density and acidity of milk.
- 2. Estimate the received results.

- 3. Offer actions for improvement of nutrition.
- 4. Record the laboratory work report.

### *Determination of bread porosity.*

Equipment: scales, Zhuravlyov's device (figure 8).

Work performance:

- a. a crumb of bread (volume is 27 cm<sup>3</sup>) is cut out by Zhuravlyov's device and weighed;
- b. porosity is found out by the formula:

$$P = 100 - 3,086 \times A,$$

where P - bread porosity in %,

A - weight of bread with the volume 27 cm<sup>3</sup>.



**Figure 8.** Zhuravlyov's device.

### *Hygienic estimation.*

Normal value of bread porosity is 45-50 %.

### *Determination of bread acidity.*

Equipment: conical flasks, funnels, measured cylinders, 0.1N NaOH solution, 2 % solution of phenolphthaleinum, cleared water.

Work performance:

- a. 50 cm<sup>3</sup> of bread extract is selected in conical flask;
- b. 2-3 drops of phenolphthaleinum are added;
- c. the solution is titrated by 0.1N NaOH solution till pink color appearance;
- d. bread acidity will be equal to double quantity of cm<sup>3</sup> of alkali which has been used on titration.

*Hygienic estimation.*

Normal value of bread acidity is not above 12<sup>0</sup> Turners.

*Determination of milk density.*

Equipment: measured cylinders, lactodensimeter (figure 9).

Work performance:

- a. investigated milk is carefully mixed and 170-190 sm<sup>3</sup> poured in glass cylinder;
- b. lactodensimeter is lowered into cylinder;
- c. indications are written down.



**Figure 9.** Lactodensimeter.

*Hygienic estimation.*

Normal value of milk density is 1.028 – 1.034.

*Determination of milk acidity.*

Equipment: measured cylinders, conical flasks, 0.1N NaOH solution, 2 % solution of phenolphthaleinum, cleared water.

Work performance:

- a. milk is mixed, 10 cm<sup>3</sup> is selected and poured into conical flask;
- b. 20 cm<sup>3</sup> of cleared water and 2-3 drops of phenolphthaleinum are added and mixed;
- c. the solution is titrated by 0.1N NaOH solution till pink color ap-

pearance;

d. milk acidity will be equal to tenfold quantity of  $\text{sm}^3$  of alkali in  $\text{sm}^3$  which has been used on titration (counting on  $100 \text{ cm}^3$ ).

*Hygienic estimation.*

Normal value of milk acidity is 16-22° Turners.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

There are the following parameters of the milk: density – 1.017, fat content – 1.2 %, acidity - 25° of Turner. Estimate the milk quality and offer actions for its usage.

*The algorithm of task's solution:*

Milk does not correspond to the hygienic requirements: density (normal is 1.028-1.034) and fat content (normal is 3.5 %) are lowered, acidity (normal is 16-22°) is raised.

It is necessary to recognize the milk substandard product. The milk is impossible to use and it is necessary to destroy or use for animal feeding.

**1.** There are the following parameters of the milk: density – 1.025, fat content – 2.2 %, acidity - 23° of Turner. Estimate the milk quality and offer actions for its usage.

**2.** There are the following parameters of the bread: humidity - 65 %, porosity - 35 %, acidity - 14° of Turner. Estimate the bread quality and offer actions for its usage.

**3.** There are the following parameters of the milk: density – 1.010, fat content – 1.2 %, acidity - 18° of Turner. Estimate the milk quality and offer actions for its usage.

**4.** There are the following parameters of the bread: humidity - 70 %, porosity - 40 %, acidity - 17° of Turner. Estimate the bread quality and offer actions for its usage.

**5.** There are the following parameters of the milk: density – 1.038, fat maintenance – 5.0 %, acidity - 19° of Turner. Estimate the milk quality and offer actions for its usage.

**6.** There are the following parameters of the bread: humidity - 55 %, porosity - 45 %, acidity - 13° of Turner. Estimate the bread quality and offer actions for its usage.

7. There are the following parameters of the milk: density – 1.039, fat maintenance – 0.1 %, acidity - 24° of Turner. Estimate the milk quality and offer actions for its usage.

8. There are the following parameters of the bread: humidity - 53 %, porosity - 38 %, acidity - 15° of Turner. Estimate the bread quality and offer actions for its usage.

9. There are the following parameters of the milk: density – 1.022, fat content – 2.3 %, acidity - 23° of Turner. Estimate the milk quality and offer actions for its usage.

10. There are the following parameters of the bread: humidity - 48 %, porosity - 48 %, acidity - 11° of Turner. Estimate the bread quality and offer actions for its usage.

#### **The literature.**

1. Lecture № 4.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 61-64.

**Laboratory classes № 10.****The topic: FOOD POISONINGS AND THEIR PREVENTION**

*The theme is of great importance for the further training at clinical departments, in practical work of a doctor for prevention and investigation of food poisonings.*

**Aim of the Lesson:** to be able to assess foodstuffs quality, to investigate the food poisoning and to propose actions for their prevention.

**Checking Questions.**

- ✓ 1. Food poisonings, their classification.
- ✓ 2. Characteristic of microbial nature food poisonings.
- ✓ 3. Characteristic of not microbial food poisonings and food poisonings of unstated aetiology.
- ✓ 4. Prevention of food poisonings.
- ✓ 5. Investigation of food poisonings.
- ✓ 6. Methods of studying and estimation of foodstuffs safety.

**Multiple Choice Questions.****Choose proper answers**

1. Classification of food poisonings is:
  - 1) microbial nature;
  - 2) artificial;
  - 3) mycotoxicosis;
  - 4) not microbial nature;
  - 5) not specified.
2. Food poisonings of microbial nature are:
  - 1) poisonings by chemioxenobiotics;
  - 2) food toxinfection (toxicoses);
  - 3) poisonings by products, poisonous by nature;
  - 4) mycotoxicosis;
  - 5) food intoxication.
3. Food poisonings of not microbial nature are:
  - 1) poisonings by vegetative products at certain conditions;
  - 2) food intoxication;
  - 3) poisonings by products, poisonous by nature;
  - 4) poisonings by animal products at certain conditions;

- 5) poisonings by chemioxenobiotics.
4. Signs of food poisonings are:
  - 1) sudden beginning;
  - 2) family character;
  - 3) short incubatory period;
  - 4) communication with food;
  - 5) heat.
5. The following symptoms of food poisonings are:
  - 1) diarrhea;
  - 2) gastroenteritis;
  - 3) vomiting;
  - 4) headache;
  - 5) abdominal pain.
6. Usage of dairy products can cause:
  - 1) salmonellosis;
  - 2) necrotic enteritis;
  - 3) aflatoxicosis;
  - 4) botulism;
  - 5) staphylococcal toxicoses.
7. Usage of peanut, soya, corn, rice, wheat can cause:
  - 1) aflatoxicosis;
  - 2) salmonellosis;
  - 3) disease;
  - 4) botulism;
  - 5) staphylococcal toxicoses.
8. Symptoms of aflatoxicosis are:
  - 1) necrotic enteritis;
  - 2) defects of liver;
  - 3) marasmus;
  - 4) defects of nervous system;
  - 5) defects of immune system.
9. Usage of meat and fish products can cause:
  - 1) salmonellosis;
  - 2) necrotic enteritis;
  - 3) aflatoxicosis;
  - 4) botulism;
  - 5) staphylococcal toxicoses.
10. Feed mycotoxicosis are:
  - 1) ergotism;

- 2) fusarialtoxicosis;
- 3) botulism;
- 4) aflatoxicosis;
- 5) salmonellosis.

**11. Prevention of bacterial food poisoning:**

- 1) timely revealing of sick persons and carriers among workers;
- 2) correct conservation of foodstuff in house conditions;
- 3) sanitary and epidemiological supervision at public catering establishments;
- 4) control over pollution of grain and its correct storage, struggle against illnesses of agricultural plants;
- 5) storage of products with observance of temperature regimen, transportation with special transport, cooking with observance of technology requirements.

**12. Botulism phenomena are:**

- 1) gastroenteritis;
- 2) paralysis of soft palate;
- 3) cardiovascular diseases;
- 4) paralysis of eye muscles;
- 5) speech disturbance.

**13. Sorts of microscopic mushrooms are:**

- 1) Fusarium;
- 2) Claviceps;
- 3) Aspergillus;
- 4) Clostridium;
- 5) Botulinum.

**14. Muscarinic symptoms due to mushrooms poisoning are:**

- 1) miosis;
- 2) bronchorrhea;
- 3) bradycardia;
- 4) diaphoresis;
- 5) wheezing.

**15. Poisonous plants are:**

- 1) castor bean;
- 2) jequirity bean;
- 3) hemlock;
- 4) oleander;
- 5) foxglove.



### **Laboratory Work.**

- 1. Study safety of canned food, spend food poisoning investigation.
- 2. Estimate the received results.
- 3. Offer actions for food poisoning prevention.
- 4. Record the laboratory work report.

#### ***Determination of canned food safety.***

It is necessary to learn the documents certifying the origin and quality of products then perform external examination, finding out the status of packaging, labels, production date, batch number, selectively open containers and products are subjected to the organoleptic examination.

#### ***Hygienic estimation.***

During the examination the following products can be identified:

1. products suitable for food without limitation;
2. products suitable for food of the lowered quality;
3. conditionally suitable products;
4. substandard product (product of bad quality).

#### ***The scheme of food poisoning investigation.***

- a. Collect the anamnesis.
- b. Withdraw from the usage the suspicious food and take sample for analysis (200-300 g).
- c. Collect the vomitive and fecal masses of patients, waters after gastric lavage and urine (100-200 ml) for bacteriological analysis, take 10 ml of blood for plating on haemoculture in sterile ware.
- d. Direct the withdrawn food, collected vomitive and fecal masses and waters after gastric lavage on research in the bacteriological laboratory.
- e. Forbid realization of suspicious products before finding-out of all fact of the case.
- f. Immediately inform about food poisoning by phone to the territorial hygiene and epidemiology centre.
- g. Help to victims.

## **Solve a problem, estimate the obtained data and request actions for their improvement**

### **Situational Task.**

The female-student of 18 years old has eaten 100 g of homemade smoked fish (sevruga) and drunk a cup of tea with a piece of white bread. In a day she felt dizziness, pain in stomach, her pupils became irregularly dilated, eyelids descended, she had speech confusion, frequent pulse, temperature was 35°C. That evening she died. Investigate the food poisoning and offer preventive actions.

#### *The algorithm of task's solution:*

It is possible to suspect the poisoning by botulinic toxin. For diagnosis specification it is necessary to put biological test on mice with the suspicious foodstuff, and after death of the patient - with the cadaveric (corpse) material. For death prevention it is necessary to inject the polyvalent botulinic Serum to the patient. The fish of house preparation was the poisoning source.

For botulism prevention it is necessary to spend the conservation of products in a proper way, before usage of the product expose it to the thermal processing, at doubt in quality a such product should not be used.

**1.** During the sanitary examination of meat 2 larvae of trichina in 12 compressed preparations were found. Estimate the quality of meat and offer actions for its improvement.

**2.** The student has eaten 120 g of homemade smoked fish and drunk a cup of tea. In a day he felt pain in stomach, pupils became irregularly dilated, eyelids descended, he had speech confusion. That evening he died. Investigate the food poisoning and offer preventive actions.

**3.** The student has eaten the stale cake and drunk a cup of coffee for breakfast. In 2 hours he felt pain in stomach, weakness, dizziness and began to vomit. Investigate the food poisoning and offer preventive actions.

**4.** The worker has eaten a portion of cottage cheese with sour-cream and drunk a cup of milk for breakfast. In an hour he felt nausea, weakness, headache, his temperature raised. Next day the worker felt much better. Investigate the food poisoning and offer preventive actions.

**5.** The student has eaten remained from a supper cowheel and drunk a glass of compote for breakfast. After 6 hours he has 39°C temperature,

weakness, dizziness, vomiting. Investigate the food poisoning and offer preventive actions.

6. The bank clerk has arrived into the clinic with complaints to strong muscular weakness, headache, vision easing, doubling in eyes, difficulty of swallowing. Temperature was normal. It is established, that one day prior to disease the patient has eaten the country-cured ham with potato. Investigate the food poisoning and offer preventive actions.

7. During the sanitary examination of meat 3 pork measly (cysticercus) at the area 20 cm<sup>2</sup> and 4 larvae of trichina in 24 compressed preparations were found. Estimate the quality of meat and offer actions for its improvement.

8. During the sanitary examination of meat 5 pork measly (cysticercus) at the area 20 cm<sup>2</sup> and 2 larvae of trichina in 12 compressed preparations were found. Estimate the quality of meat and offer actions for its improvement.

9. The girl has eaten the stale cake and drunk a cup of coffee for breakfast. In 2 hours she felt pain in stomach, weakness, dizziness and began to vomit. Investigate the food poisoning and offer preventive actions.

10. The man has eaten a portion of cottage cheese with sour-cream and drunk a cup of milk for breakfast. In an hour he felt nausea, weakness, headache, his temperature raised. Next day the man felt much better. Investigate the food poisoning and offer preventive actions.

#### **The literature.**

1. Lecture № 4.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 64-70.

**Laboratory classes № 11.**  
**The topic: HYGIENIC CHARACTERISTIC  
OF MEDICAL AND PREVENTIVE NUTRITION**

*The theme is of great importance for further training at public health and public health services department, clinical departments, in practical work of a doctor for catering services of patients.*

**Aim of the Lesson:** to be able to assess preventive and medical diets and to propose actions for its optimization.

**Checking Questions.**

- ✓ 1. Hygienic bases of dietetic therapy organization.
- ✓ 2. Hygienic characteristic of medical diets.
- ✓ 3. Hygienic requirements to cooking in hospitals.
- ✓ 4. Hygienic bases of preventive nutrition organization.
- ✓ 5. Hygienic characteristic of preventive nutrition allowances.
- ✓ 6. Methods of studying and estimation of medical and preventive nutrition.

**Multiple Choice Questions.**

**Choose proper answers**

1. Milk and dairy products are prescribed at:
  - 1) gastritis with the lowered acidity;
  - 2) constipation, colitis;
  - 3) liver illnesses;
  - 4) a stomach ulcer;
  - 5) tuberculosis.
2. A dietary food is marked:
  - 1) excluding of the certain food substances in a diet;
  - 2) special technological processing of food substances;
  - 3) change of amount of chemical and mechanical stimulus;
  - 4) including of the certain food substances in a diet;
  - 5) increase of frequency of food intake.
3. Sanitary and hygienic estimation of dietary food organization in a dining room includes definition:
  - 1) sanitary and protective zone;
  - 2) order of ready food issuing;
  - 3) presence of hot water;

- 4) sanitary condition of a dining room;
- 5) nomenclatures of medical diets.
4. Principles of dietetic therapy are:
  - 1) conformity to medical indications;
  - 2) variety and food individualization;
  - 3) use of unloading methods;
  - 4) maintenance of physiological requirements of a patient;
  - 5) sparing diet.
5. The principles of nutrition promoting for prevention of cardiovascular diseases are:
  - 1) decrease in fiber value of a diet;
  - 2) equation of a food;
  - 3) reduction of animal fats in a diet;
  - 4) increase of animal fats in a diet;
  - 5) increase of power value of a diet.
6. Vitamins are given to workers:
  - 1) connected with heat influence;
  - 2) exposed to dust influence;
  - 3) managements;
  - 4) a director;
  - 5) connected with influence of low temperature.
7. A preventive food is given to workers:
  - 1) in the end of shift;
  - 2) in the beginning of work;
  - 3) in the beginning of month;
  - 4) in the end of month;
  - 5) during the lunchtime.
8. The diet № 1 is intended for workers contacting with:
  - 1) radioactive substances;
  - 2) ionising radiation;
  - 3) nitric acid;
  - 4) lacquer, paints;
  - 5) phosphoric compound.
9. The diet № 2 is intended for workers contacting with:
  - 1) radioactive substances;
  - 2) ionising radiation;
  - 3) strong nitric acid;
  - 4) paints;
  - 5) sulfuric acid.

**10.** The diet № 3 is intended for workers contacting with:

- 1) lead;
- 2) varnishes;
- 3) paints;
- 4) tin;
- 5) sulfuric acid.

**11.** The diet № 4 is intended for workers contacting with:

- 1) phosphoric compounds;
- 2) aniline;
- 3) benzene;
- 4) arsenic;
- 5) radioactive substances.

**12.** The diet № 5 is intended for workers contacting with:

- 1) sulphur-hydrate;
- 2) manganese dioxide;
- 3) lead;
- 4) strontium;
- 5) mercury compounds.

**13.** Sodium restricted diet is recommended for patients with:

- 1) cardiovascular diseases;
- 2) hypertension;
- 3) congestive heart disease;
- 4) kidney disease;
- 5) edema.

**14.** Limiting of foodstuffs for patients with atherosclerosis and heart disease:

- 1) beef;
- 2) liver;
- 3) pork;
- 4) cheese;
- 5) egg yolk.

**15.** Avoiding of foodstuffs for patients with diabetes mellitus:

- 1) desserts;
- 2) honey;
- 3) condensed milk;
- 4) sugared gum;
- 5) jams.

### **Laboratory Work.**

- 1. Study students' nutrition taking into account diseases and work in harmful conditions.
- 2. Estimate the received results.
- 3. Offer actions for organization of medical and preventive nutrition.
- 4. Record the laboratory work report.

#### Work performance:

Nutrition of students is organized in accordance with the view of diseases and work in harmful conditions.

It is necessary to assign the medical diet and the ration to the student with acute or chronic disease.

In the context of the impact on students of harmful factors (ionizing radiation sources, sulfuric acid, etc.) it is necessary to recommend the preventive ration and prescribe the vitamins.

### **Solve a problem, estimate the obtained data and request actions for their improvement**

#### **Situational Task.**

The hospital nutrition unit has the following processing departments: vegetable, meat, hot (cooking hall with distributing room), cold section, washing of kitchen ware. Warehouses are presented by the cooled room for meat and fish, pantries of vegetables and dry products. Meat is stored in the refrigerating room at temperature +6 °C together with dairy-fatty products. Estimate the lay-out and operation regimen of the nutrition unit.

#### *The algorithm of task's solution:*

Planning and operation regimen of the hospital nutrition unit mismatches to the hygienic requirements: there is no fish section and refrigerating box for dairy products and fats, conditions of meat storage are broken (meat should be stored at temperature 0°C, separately from dairy-fatty products).

It is necessary to organize the fish section, the refrigerating box for dairy and fatty products, to repair the refrigerating box for storage of meat and to observe the temperature mode.

1. The hospital nutrition unit has separate refrigerating box for meat and fish. Dairy products, fats, fruit and greens are stored in the general refrigerating box at temperature  $+5^{\circ}\text{C}$ . The not cooled warehouse is used as a storage room for dry products, bread and linen pantry. The processing premises such as hot, cold, confectionery sections are organized. Estimate the lay-out and operation mode of the nutrition unit.

2. The hospital nutrition unit has the following processing departments: vegetable, hot, cold section, washing of kitchen ware. Warehouses are presented by the cooled room for fish, pantries of vegetables and dairy products. Fish is stored in the refrigerating room at temperature  $+7^{\circ}\text{C}$  together with fruits. Estimate the lay-out and operation mode of the nutrition unit.

3. The worker which works with ionizing radiation receives milk, vitamins  $B_1$ ,  $B_2$  in addition to his daily diet. Estimate the preventive nutrition and develop actions for its improvement.

4. The worker which works with strong nitric acid receives milk, dairy products, smoked products in his daily diet. Estimate the preventive nutrition and develop actions for its improvement.

5. The worker which works with carbon disulfide receives the diet №2. Estimate the preventive nutrition and develop actions for its improvement.

6. The patient with a stomach ulcer receives products with strengthening of GIT motility action. Estimate the dietetic therapy and develop actions for its improvement.

7. The Regular Diet is prescribed for the patient with a hepatitis. Estimate the dietetic therapy and develop actions for its improvement.

8. The Liquid Diet is prescribed for the patient with ischemic illness of heart. Estimate the dietetic therapy and develop actions for its improvement.

9. The High-Calorie Diet is prescribed for the patient with adiposity. Estimate the dietetic therapy and develop actions for its improvement.

10. The Low Cholesterol Diet is prescribed to the patient with an acute gastritis. Estimate the dietetic therapy and develop actions for its improvement.

### **The literature.**

1. Lecture № 4.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 72-78.



**Laboratory classes № 12.**

**The topic: FINAL CONTROL STUDY OF CLASSES OF HYGIENE OF ENVIRONMENT, POPULATED AREAS AND NUTRITION**

*The theme has important meaning for further training at department of organization of public health services and public health, clinical departments, in practical work of a doctor.*

**Aim of the Lesson:** to be able to determine the health parameters, to assess factors and environment pollutants, city's planning and placing, conditions of residing, protein-energy full value, vitamin and mineral full value of nutrition, foodstuffs quality, nutritional status, preventive and dietetic therapy; to propose actions for prevention of food poisonings, rationalization measures, actions for prevention of their adverse influence on health, preventing actions.

**Checking Questions.**

1. Principles of the state policy in the field of public health care in the Republic of Belarus.
2. Hygiene as a science. Subject of hygiene is health and environment. Purpose, tasks, differentiation of hygiene, communication with other sciences.
3. Methodology and theoretical bases of hygiene.
4. History of hygiene development. Features of hygiene development at the present stage.
5. Value of hygiene in maintenance of population's health.
6. Hygiene of environment as a science. Value of hygiene of environment for doctors.
7. Hygienic value of physical factors of atmospheric air, water and soil.
8. Hygienic value of chemical factors of atmospheric air, water and soil.
9. Hygienic value of biological factors of atmospheric air, water and soil.
10. Prevention of adverse influence of environment factors and pollutants on health. Value of ecological medicine in prevention of environment disease.
11. Environmental pollution and its hygienic value. Medical problems of pollution.
12. Hygienic value of air pollution.
13. Hygienic value of water pollution.
14. Hygienic value of soil pollution.

15. Prevention of adverse influence of environment pollution on health. Environmental protection from pollution.
16. Planning of populated areas recently.
17. Urbanization and its hygienic value.
18. Hygienic requirements to choice of the territory for building of populated areas. Functional zoning of a city.
19. Hygienic requirements to planning and building of residential settlements and microdistricts.
20. Features of lay-out of rural populated areas.
21. Hygienic requirements to choice of the ground area for building of dwelling and building materials.
22. Hygienic requirements to internal planning of dwelling.
23. Hygienic requirements to sanitary-technical accomplishment, equipment and maintenance of dwelling.
24. Hygienic requirements to microclimate of dwelling. The prevention of overheat and dampness in dwelling.
25. Features of planning, sanitary-technical accomplishment, equipment and maintenance of hostels.
26. Hygienic value of nutrition. Hygiene of nutrition.
27. Interrelation of foodstuffs and pharmaceutical drugs.
28. Balanced diet laws.
29. Features of nutrition recently. Nutrition in adverse ecological conditions.
30. Hygienic characteristic of food status.
31. Hygienic value of nutrients.
32. Norms of physiological requirement for nutrients and energy for various groups of adult population.
33. Hygienic characteristic of proteins. Illnesses of insufficient and superfluous proteins nutrition and their prevention.
34. Hygienic characteristic of fats. Illnesses of insufficient and superfluous fatty nutrition and their prevention.
35. Hygienic characteristic of carbohydrates. Illnesses of insufficient and superfluous carbohydrate nutrition and their prevention.
36. Hygienic value of vitamins, mineral elements and water.
37. Norms of physiological requirement in vitamins and minerals for various groups of adult population.
38. Hygienic characteristic of vitamins. Illnesses of insufficient and superfluous vitamin nutrition and their prevention.
39. Hygienic characteristic of macroelements and trace elements. Illnesses

of insufficient and superfluous mineral nutrition and their prevention.

40. Hygienic characteristic of water.
41. Foodstuffs, their structure, value and efficiency.
42. Hygienic characteristic of meat, meat products and eggs.
43. Hygienic characteristic of milk and dairy products.
44. Hygienic characteristic of fish, fish products and other sea products.
45. Hygienic characteristic of bakery and flour-and-cereals products, vegetables, fruits, berries and products of their processing.
46. Food poisonings, their classification.
47. Characteristic of microbial nature food poisonings.
48. Characteristic of not microbial food poisonings and food poisonings of unstated aetiology.
49. Prevention of food poisonings.
50. Investigation of food poisonings.
51. Hygienic bases of dietetic therapy organization.
52. Hygienic characteristic of medical diets.
53. Hygienic requirements to cooking in hospitals.
54. Hygienic bases of preventive nutrition organization.
55. Hygienic characteristic of preventive nutrition allowances.

### **Laboratory Work.**

#### **I. Determine parameters.**

1. Determine primary morbidity.
2. Determine general morbidity.
3. Determine nitrites in water, methemoglobin in blood and interrelation between them.
4. Lead examination of city's general plan.
5. Determine temperature, relative humidity, speed of air movement of dwelling.
6. Determine cooling ability of dwelling.
7. Determine equivalent effective temperature of dwelling.
8. Study protein-energy full value of nutrition of students.
9. Study vitamin-mineral full value of nutrition of students.
10. Study porosity of bread.
11. Study acidity of bread.
12. Study density of milk.
13. Study acidity of milk.
14. Study food status of students.
15. Study safety of canned food, spend food poisoning investigation.

16. Develop dietetic therapy for patient with a stomach ulcer.
17. Develop dietetic therapy for patient with a hypertension.
18. Develop dietetic therapy for patient with a tuberculosis.
19. Develop preventive nutrition for the worker contacting with ionizing radiation sources.
20. Develop preventive nutrition for the worker contacting with sulfuric acid.

**II.** Estimate the received results.

**III.** Offer actions for patients' improvement, for prevention of adverse influence of water chemical factors on health, prevention of malnutrition, food poisoning prevention and investigation, offer actions for its prevention.

**IV.** Record the laboratory work report.

**The literature.**

1. Lectures 1-4.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 4-73.

**Laboratory classes № 13.****The topic: HEALTH SERVICES OF WORKERS**

*The theme is of great importance for the further training at clinical departments, in practical work of a doctor for professional pathology prevention.*

**Aim of the Lesson:** to be able to organize medical inspection of workers and to propose sanitary-hygienic actions for improvement of working conditions and medical-improving actions for workers' health.

**Checking Questions.**

- ✓ 1. Hygiene of work. Hygienic characteristic of working conditions.
- ✓ 2. Professional diseases, they prevention and investigation.
- ✓ 3. Medical sanitary unit of enterprises, structure, tasks.
- ✓ 4. Health services of workers.
- ✓ 5. Organization and carrying out of medical inspections.
- ✓ 6. Methods of studying and estimation of working conditions.

**Multiple Choice Questions.****Choose proper answers**

1. Structure of a medical-sanitary unit (MSU) is:
  - 1) hospital;
  - 2) polyclinic;
  - 3) medical center;
  - 4) kinder garden;
  - 5) sanatorium.
2. A special department that should be included in the structure of a hospital MSU is:
  - 1) diagnostic;
  - 2) ambulance;
  - 3) blood transfusion unit;
  - 4) professional pathology;
  - 5) disability.
3. The main principle of workers' health service is:
  - 1) principle of harmfulness;
  - 2) principle of activity;
  - 3) ambulance principle;
  - 4) urgent principle;

- 5) sectorial principle.
4. The number of workers that a factory's sectorial doctor should serve is:
- 1) 500;
  - 2) 1000;
  - 3) 2000;
  - 4) 3000;
  - 5) 4000.
5. Duties of a factory's sectorial doctor are:
- 1) qualified medical assistance to workers;
  - 2) organization and carrying out of preliminary and periodic medical inspections;
  - 3) realization of dispensary supervision over patients' health;
  - 4) carrying out of against-epidemic work;
  - 5) hygienic training and education.
6. Tasks of medical inspections are:
- 1) definition of suitability of workers and employees to work;
  - 2) maintenance of work safety and prevention of infectious and parasitic diseases distribution;
  - 3) revealing of persons with professional diseases;
  - 4) working out of individual medical improving actions concerning patients with occupational diseases;
  - 5) liquidation of reasons, causing professional disease.
7. Types of obligatory medical inspections are:
- 1) predictable;
  - 2) preliminary;
  - 3) final;
  - 4) frequent;
  - 5) periodic.
8. Tasks of periodic medical inspections are:
- 1) duly revealing of early stages of diseases;
  - 2) prevention of professional pathology;
  - 3) definition of professional suitability;
  - 4) definition of professional suitability;
  - 5) revealing of diseases which are contraindications to work.
9. Zones of industrial platform are:
- 1) economic;
  - 2) industrial buildings;
  - 3) office buildings;
  - 4) rest;

- 5) warehouse.
- 10.** Parameters of industrial premises per one worker are:
  - 1) volume of air should be not less than  $15 \text{ m}^3$ ;
  - 2) area should be not less than  $4.5 \text{ m}^2$ ;
  - 3) height should be not less than 3.2 m;
  - 4) area should be not less than  $9 \text{ m}^2$ ;
  - 5) height should be not less than 2.5 m.
- 11.** Structure of sanitary-household premises is:
  - 1) health centres;
  - 2) wardrobe;
  - 3) washroom;
  - 4) rooms of personal hygiene of women;
  - 5) inhalator.
- 12.** Types of mechanical ventilation at industrial premises are:
  - 1) affluent;
  - 2) exhaust;
  - 3) forced-exhaust local;
  - 4) forced-exhaust general;
  - 5) central.
- 13.** Hygienic requirements to equipment of industrial enterprises:
  - 1) should have smooth surface;
  - 2) should be stable against chemical, medicinal and disinfectant materials;
  - 3) should be serviceable;
  - 4) should be safe;
  - 5) should be up-to-date.
- 14.** Hygienic requirements to keeping of premises and equipment of industrial enterprises:
  - 1) should be kept clean;
  - 2) should be exposed to regular disinfection;
  - 3) should be exposed to regular clearing;
  - 4) should maintain the optimum temperature;
  - 5) should maintain the optimum pressure.
- 15.** Types of industrial illumination are:
  - 1) natural;
  - 2) upper, lateral and combined;
  - 3) artificial;
  - 4) local, general and combined;
  - 5) incandescent and luminescent lamps.

### Laboratory Work.

- 1. Organize preliminary and periodic medical inspection for definition of professional suitability of workers to work in harmful conditions.
- 2. Give the conclusion about professional suitability of workers and specify the list of contra-indications for work in the given trade.
- 3. Offer actions for rational employment of workers and improvement of working conditions.
- 4. Record the laboratory work report.

#### Organization of preliminary (periodic) medical examination to the worker who works with antibiotics (industrial vibration)

Obligatory medical examinations are organized in accordance with the Order of the Ministry of Health Care of the Republic of Belarus № 47, 28.04.2010 "Procedure of obligatory medical examinations of workers". It is required to find the harmful or dangerous factor in the second column of the table, in this case it is the factor of biological nature - antibiotics and physical - vibration. It is necessary to determine the doctors-specialists which provide the examination, functional and necessary laboratory tests and medical contraindications. For periodic medical examination the order of its passing is also specified.

№№	Hazardous and harmful substances and production factors	Nature of the work, technological processes	Beginning of medical examination and duration	Basic medical specialists	Laboratory and functional research	Medical contraindications in addition to general contraindications
1	2	3	4	5	6	7
2.2	antibiotics	production and use in medical and veterinary practice and pharmacies	1 time per year	physician, dermatologist, otolaryngologist, obstetrician-gynecologist	leukocyte formula, general urine analysis	1) allergic diseases 2) often aggravated chronic bronchitis, chronic pneumonia 3) candidiasis, mycosis, goiter 4) chronic diseases of the urinary tract 5) subatrophic changes of the top respiratory ways



4.3	<b>industrial vibration</b>	all types of work involving exposure to: - local vibration in excess of MPL up to 6 dB; - in excess of MPL up to 7 dB or more; - general vibration	once every 3 years  1 time in 2 years  1 time in 2 years	physician, neuropatologist, otolaryngologist (obstetrician), ophthalmologist, surgeon (by prescription ))	cold test , vibration sensitivity: investigation of the vestibular apparatus ( when worker is exposed to general vibration )	1) oblitiruyuschy occlusive disease, Raynaud's disease, peripheral angeospazm 2) chronic diseases of the peripheral nervous system 3) violation of the vestibular apparatus of any etiology , including Meniere's disease 4 ) abnormalities position of female genital mutilation; chronic inflammation and diseases of the uterus and appendages with frequent aggravations 5 ) high and complicated myopia (over 8.0 D)
<b>Page. 41</b>						

### **Solve a problem, estimate the obtained data and request actions for their improvement**

#### **Situational Task.**

The nurse who is constantly working with antibiotics passes the periodic medical examination 1 time every two years with the participation of therapist, obstetrician-gynecologist. She performs the urinalysis. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

#### *The algorithm of task's solution:*

The medical examination of the nurse is organized in violation of Regulation of Ministry of Health of the Republic of Belarus "On the procedure of compulsory medical examinations of workers» № 33 dated by 08.08.2000. The multiplicity of medical examination has been broken (the required multiplicity is 1 time every year). Dermatologist and otolaryngologist have not been involved, the study of blood leukocyte counts has not been held.

It is necessary to increase the multiplicity of passing of the medical examination with the involving of the required doctors into the commission and to perform the laboratory tests in full.

**1.** The laboratory doctor examining the infected and affected by helminthes material is undergone to the periodic medical examination 1

time every quarter with the involvement of therapist, infectionist and obstetrician-gynecologist. He performs the research on blood leukocyte formula. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

2. The dentist constantly working with arsenic is undergone to the periodic medical examination 1 time every two years with the involvement of therapist, obstetrician-gynecologist, otolaryngologist. He performs the general analysis of blood and urine. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

3. The radiologist is undergone to the periodic medical examination 1 time every 2 years with the involvement of therapist, infectionist, obstetrician-gynecologist. He performs the blood leukocyte formula. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

4. The nurse constantly working in the tuberculosis dispensary is undergone to the periodic medical examination 1 time per year with the involvement of therapist, obstetrician-gynecologist, infectionist, ophthalmologist. She performs the general analysis of urine, blood, ultrasound of the abdomen. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

5. The laboratory technician working with formaldehyde is undergone to the periodic medical examination 1 time every 6 months with the involvement of therapist, surgeon, obstetrician. He researches urine and blood leukocyte formulas. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

6. The storekeeper of the pesticides warehouse is undergone to the periodic medical examination 1 time every 3 years with the involvement of therapist and neurologist. He performs the urinalysis. The storekeeper suffers from chronic radiculitis and neuritis of neuritis of the auditory nerve. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

7. The worker employed by lead smelting has hemoglobin of 110 g/l and frequent exacerbations of chronic hepatitis. The worker is undergone to the periodic medical examination 1 time every year with the involvement of therapist and neurologist. He performs the research on blood leukocyte formula. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

**8.** The worker engaged in the production of nitric acid has hypertrophic laryngitis. The worker is undergone to the periodic medical examination 1 time in 3 years with the involvement of therapist. The laboratory and functional studies have not been conducted. Assess the correctness of the organization and performing of the medical examination and suggest measures for its optimization.

**9.** The industrial enterprise (1<sup>st</sup> class) is situated in 300 meters from the inhabited area. The total area of the enterprise includes 70% of buildings. The volume of the premise per one worker is 7 m<sup>3</sup>, the square of the premise per one worker is 3 m<sup>2</sup>. The personal hygiene rooms for women and wardrobes and washing-up rooms are not organized. Water supply is centralized. Solid wastes are not gathered. Estimate the planning, development and maintenance of the industrial enterprise and offer actions for its improvement.

**10.** The secondary-processing plant (3<sup>rd</sup> class) is situated in the suburb of the city. The protective zone is 50 meters. The school and City Park are inside the protective zone. The volume of the premise per one worker is 10 m<sup>3</sup>, the square of the premise per one worker is 4 m<sup>2</sup>. The sectors with high heat-production are located near outer walls of one-stored building. Wardrobe, washing-up room, personal hygiene room, first-aid post are included in sanitary premises content. Water supply is centralized. Canalization is not provided. Estimate the planning, development and maintenance of the industrial enterprise and offer actions for its improvement.

#### **The literature.**

1. Lecture № 5.
2. Hygiene: Tutorial / N.I. Miklis, S.I.Korikova, I.I.Burak. – Vitebsk: VSMU, 2012. – P. 79-85.

**Laboratory classes № 14.**

**The topic: OCCUPATIONAL DISEASES  
CAUSED BY PHYSICAL INDUSTRIAL FACTORS AND DUST**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for professional pathology prevention.*

**Aim of the Lesson:** to be able to make the diagnostics, investigation and prevention of occupational diseases caused by physical factors of industrial environment and dust.

**Checking Questions.**

- ✓ 1. Occupational diseases caused by influence of noise, ultrasound, infrasound and their prevention.
- ✓ 2. Occupational diseases caused by vibration and their prevention.
- ✓ 3. Occupational diseases caused by influence of factors of microclimate, pressure and their prevention.
- ✓ 4. Occupational diseases caused by influence of ultra-violet, laser and ionizing radiations and their prevention.
- ✓ 5. Professional pathology caused by dust and their prevention.
- ✓ 6. Methods of studying and estimation of physical factors of industrial environment and dust.

**Multiple Choice Questions.**

**Choose proper answers**

1. Dust professional diseases are:
  - 1) pneumoconiosis;
  - 2) chronic bronchitis;
  - 3) conjunctivitis;
  - 4) antracosilicosis;
  - 5) antracotalcosis.
2. Noise influence leads to:
  - 1) decrease in hearing;
  - 2) defeat of CNS;
  - 3) increase of blood pressure;
  - 4) easing of resistance of an organism;
  - 5) metabolism infringement.
3. Ultrasound influence leads to:
  - 1) loss of sensitivity;

- 2) vestibular infringements;
  - 3) general weakness;
  - 4) sleep frustration;
  - 5) headaches.
- 4. Infrasound influence leads to:**
- 1) weakness;
  - 2) fast fatigue;
  - 3) nervously and mental infringements;
  - 4) working capacity decrease;
  - 5) polyneuritis.
- 5. Symptoms caused by local vibration are:**
- 1) changes of painful and temperature sensitivity;
  - 2) myocardial dystrophy;
  - 3) cold snap of fingers of hands;
  - 4) pains in the heart and stomach;
  - 5) deformation of joints.
- 6. Symptoms caused by general vibration are:**
- 1) spasm and atony of small vessels;
  - 2) easing of skin sensitivity;
  - 3) expressed changes from central nervous, osteomuscular and blood systems;
  - 4) spasm of coronary vessels;
  - 5) myocardial dystrophy.
- 7. Parameters of microclimate are:**
- 1) optimal;
  - 2) discomfortable;
  - 3) admissible;
  - 4) unsuitable;
  - 5) comfortable.
- 8. Influence of heating up microclimate causes:**
- 1) skin temperature raises;
  - 2) water-salt exchange is broken;
  - 3) organism dehydration;
  - 4) loss of mineral salts and water soluble vitamins;
  - 5) activity of cardiovascular, respiratory and other systems changes.
- 9. Hypobaropathy is characterized by:**
- 1) headaches;
  - 2) infringement of movements coordination;
  - 3) deformation of joints;

- 4) sight and hearing frustration;
  - 5) depression.
- 10.** Influence of industrial ultraviolet radiation causes:
- 1) photoophthalmia;
  - 2) dermatitis;
  - 3) hypothermia;
  - 4) itch;
  - 5) headaches.
- 11.** Symptoms of pneumoconiosis are:
- 1) chronic coughing;
  - 2) byssinosis;
  - 3) shortness of breath;
  - 4) cataract;
  - 5) swelling in the legs due to excessive strain on the heart.
- 12.** Symptoms caused by work on computer are:
- 1) decrease of eyes working capacity;
  - 2) asthenopia;
  - 3) headache;
  - 4) photophobia;
  - 5) hands tendinitis.
- 13.** Preventions of harmful influence of computer are:
- 1) duration of continuous work should not exceed 25 min;
  - 2) removal of harmful substance;
  - 3) performance of relaxation exercises for eyes, muscles of neck, shoulders and palms;
  - 4) image on display screen should be accurate, contrast, not have reflexions from surrounding subjects;
  - 5) sizes of furniture should correspond to height of workers.
- 14.** Influence of lasers radiation causes:
- 1) rupture of tissues and change of their properties;
  - 2) functional frustration of central nervous system;
  - 3) functional frustration of cardiovascular and endocrine systems;
  - 4) changes of peripheral blood;
  - 5) cataract, blindness.
- 15.** Prevention actions of professional illnesses are:
- 1) legislative;
  - 2) technological;
  - 3) sanitary-technical;
  - 4) working;

5) organizational.

### **Laboratory Work.**

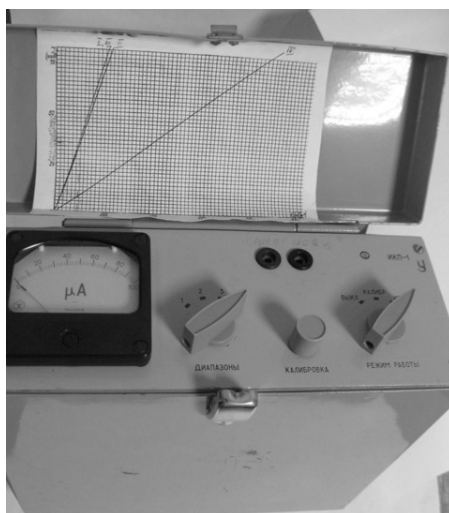
- 1. Determine dust concentration in air of working zone and thermal irradiation of workers.
- 2. Estimate the received results.
- 3. Investigate the occupational disease and offer preventive actions.
- 4. Record the laboratory work report.

#### ***Determination of dust concentration in air by automatic method.***

Equipment: the measuring instrument of dust concentration (ИКП-1) (figure 10).

Work performance:

- a. the device is switched on;
- b. switch "Operating mode" is established in position "Measurement";
- c. readings of the device's microammeter are taken in 10 sec;
- d. dust concentration indoors is determined by graphic method.



**Figure 10.** Measuring instrument of dust concentration.

#### ***Determination of dust concentration in air by weight method.***

Equipment: electroaspirator (figure 11), filters, analytical scales.

Work performance:

- a. the filter is weighed on analytical scales and placed in the cartridge;
- b. investigated air is sucked through the aspirator with 25 dm<sup>3</sup>/min speed during 20 minutes;
- c. the filter is weighed again;
- d. dust content in air is counted under the formula:

$$X = (A-B) \times 1000 / V_0,$$

where X - required concentration, (mg/m<sup>3</sup>),

A - weight of the filter after air aspiration (mg),

B - weight of the filter before air aspiration (mg),

V<sub>0</sub> - volume of investigated air (m<sup>3</sup>).



**Figure 11.** Electroaspirator.

#### *Hygienic estimation.*

In air of a working zone of industrial enterprises maximum permissible concentration of dust with silicon dioxide admixture 2-10 % is 4 mg/m<sup>3</sup>, 10-70 % - 2 mg/m<sup>3</sup>, more than 70 % - 1 mg/m<sup>3</sup>.

#### ***Determination of thermal irradiation (intensity of infra-red radiation).***

Equipment: thermoelectrical aktinometer (figure 12).

Work performance:

- a. pointer of the galvanometre is established on zero position at closed cover;
- b. cover is opened and directed with the thermo receive part to the radiation source, holding the device in vertical position;
- c. the indications of galvanometre are read after 2-3 seconds;



d. galvanometre scale is graduated in small calories on 1 sm<sup>2</sup> a minute, within intensity of radiation from 0 to 20 kal/sm<sup>2</sup>/minutes, each division of the scale corresponds to 0.5 cal.

*Hygienic estimation.*

Thermal irradiation of workers should be no more than 35 Vt/m<sup>2</sup> at irradiation of 50 % and more of body surface, 70 Vt/m<sup>2</sup> - at irradiation of 25-50 %, 100 Vt/m<sup>2</sup> - at irradiation no more than 25 % of body surface.



**Figure 12.** Thermoelectrical aktinometer.

***The scheme of the statement of investigation of occupational disease (poisoning).***

- Account group in the state register.
- A place of drawing up of the statement.
- The enterprise's name. Shop, sector.
- Investigation date, the commission members (Chief Inspector of labour safety, sectorial doctor, doctor-hygienist, safety engineer, a person of trade union): First name, middle initial, last name, a post, a work place.
  - The date and hour of an incident.
  - The notice has arrived to the Hygiene and epidemiology center (the date, an hour).
  - The establishment which has diagnosed the case.
  - The disease was revealed during routine physical examination/during visit to a doctor.
- The victim (first name, middle initial, last name), age, sex, trade (post). The work experience in the given trade, in the given shop. The experience of work in the conditions of the harmful production factors influ-

ence which have caused the disease.

- The diagnosis (preliminary, definitive, basic).
- The victim's state of health at the moment of investigation (work capacity in the trade, is on out-patient treatment, is hospitalized, the sick-list, number of days, is registered as a disabled person, has died).
- Occupational disease has arisen under the following circumstances and working conditions (the detailed description of concrete factors is given).
- The immediate cause of the occupational disease is: the raised dust content of the working zone air (concentration of dust average, maximum); gassed air of the working zone (concentration of substances average, maximum); noise level (parameters in dB and the frequency characteristic); level of the general and local vibration (the frequency characteristic); other harmful production factors.

On the basis of the investigation results it was established by the commission that the present case of occupational disease has resulted from (concrete circumstances and conditions are specified), the immediate cause of the disease (poisoning) was (the concrete harmful production factor).

First name, middle initial, last name, a post of the persons responsible for the sanitary-and-hygienic norms performance and rules of labour safety.

In order to eliminate and to prevent occupational diseases it is offered (concrete organizational, technical, sanitary and hygienic actions, the official and term of its performance).

The date. Signatures of commission members.

**Solve a problem, estimate the obtained data and request actions for their improvement**

### **Situational Task.**

In the mechanical workshop equivalent noise level in constant workplaces is 90 dB, equivalent corrected level of local vibration is 118 dB, dust content with 2 % of dioxide silicon admixture is 5 mg/m<sup>3</sup>. Esti-

mate the physical factors and dust content and offer actions for their optimization.

*The algorithm of task's solution:*

The level of physical factors and dust content in mechanical shop mismatches to the hygienic requirements: equivalent noise level (80 dB) is exceeded, equivalent corrected level of local vibration (76 dB) is raised, dust content (maximum concentration limit is  $4 \text{ mg/m}^3$ ) is raised.

It is necessary to carry out the actions for control of noise, vibration, dust content (technological, sanitary-engineering, planning, organizational). Concerning workers it is recommended to perform the treatment-prophylactic actions (periodic medical examination, physiotherapeutic procedures, sanatorium treatment, etc.). Workers should use the individual protection means of ears, breath, sight, mittens.

**1.** In reactor workshop temperature is  $28^\circ\text{C}$  (warm period of year), humidity is 70%, air movement rate is 0.4 m/s. Thermal radiation of worker is  $50 \text{ Wt/m}^2$ . Estimate the microclimate and offer actions for its improvement.

**2.** In mechanic workshop temperature is  $26^\circ\text{C}$  (cold period of year), humidity is 85%, air movement rate is 0.2 m/s. Thermal radiation of worker is  $90 \text{ Wt/m}^2$ . Estimate the microclimate and offer actions for its improvement.

**3.** In pressing workshop temperature is  $18^\circ\text{C}$  (cold period of year), humidity is 85%, air movement rate is 0.5 m/s. Thermal radiation of worker is  $30 \text{ Wt/m}^2$ . Estimate the microclimate and offer actions for its improvement.

**4.** In model workshop temperature is  $17^\circ\text{C}$  (cold period of year), humidity is 45%, air movement rate is 0.2 m/s. Thermal radiation of worker is  $70 \text{ Wt/m}^2$ . Estimate the microclimate and offer actions for its improvement.

**5.** In assembly workshop where high accuracy work is performed natural illumination factor is 1%, illumination with luminescent lamps is 250 lx. Estimate the illumination of the workshop and offer actions for its improvement.

**6.** In mechanic workshop (high accuracy is not required) natural illumination factor is 0.5%, illumination with luminescent lamps is 100 lx. Estimate the illumination of the workshop and offer actions for its improvement.

**7.** In mechanic workshop equivalent noise level is 90 dB, content of dust with 2% of SiO<sub>2</sub> admixture is 5 mg/m<sup>3</sup>. Estimate the physical factors in the workshop and offer actions for its improvement.

**8.** In reactor workshop equivalent noise level is 97 dB, content of dust with 2% of SiO<sub>2</sub> admixture is 7 mg/m<sup>3</sup>. Estimate the physical factors in the workshop and offer actions for its improvement.

**9.** In assembly workshop noise level is 74 dB (frequency – 8000 Hz), content of asbestos dust is 3 mg/m<sup>3</sup>. Estimate the physical factors in the workshop and offer actions for its improvement.

**10.** In pressing workshop equivalent noise level is 105 dB, content of talcum dust is 5 mg/m<sup>3</sup>. Estimate the physical factors in the workshop and offer actions for its improvement.

#### **The literature.**

1. Lecture № 5.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 74-85.

**Laboratory classes № 15.****The topic: PROFESSIONAL POISONINGS  
CAUSED BY CHEMICAL INDUSTRIAL FACTORS**

*The theme has important value for the further training at clinical departments, in practical work of a doctor for estimation of production factors and prevention of professional pathology.*

**Aim of the Lesson:** to be able to make the diagnostics, investigation and prevention of occupational poisoning caused by chemical factors of industrial environment.

**Checking Questions.**

- ✓ 1. Industrial poisons, classification. Receipt, distribution, metabolism and excretion of poisons. Influence of poisons on organism.
- ✓ 2. Toxicity and toxicologic hazard of industrial poisons. Toxicometry.
- ✓ 3. Occupational poisonings caused by influence of organic solvents, acids, alkalis, compound of nitrogen, sulphur and carbon.
- ✓ 4. Occupational poisonings caused by influence of chlorine, iodine, mercury, beryllium, lead, manganese, chrome.
- ✓ 5. Occupational poisonings prevention.
- ✓ 6. Methods of studying and estimation of chemical production factors.

**Multiple Choice Questions.****Choose proper answers**

1. Toxicity – is:
  - 1) possibility of intoxication occurrence at manufacture;
  - 2) degree of poisoning expression;
  - 3) measure of poison compatibility with life;
  - 4) ability to cause an acute poisoning;
  - 5) ability to cause a chronic poisoning.
2. Hazard – is:
  - 1) possibility of intoxication occurrence at manufacture;
  - 2) degree of poisoning expression;
  - 3) measure of poison compatibility with life;
  - 4) ability to cause an acute poisoning;
  - 5) ability to cause a chronic poisoning.
3. Professional poisonings can be:
  - 1) acute;

- 2) latent;
  - 3) subacute;
  - 4) chronic;
  - 5) subchronic.
- 4.** Actions of chemical poisons on an organism are:
- 1) toxic;
  - 2) psychotic;
  - 3) lacrimatory;
  - 4) gonadotoxic;
  - 5) embriotoxic.
- 5.** Chronic professional poisoning arises after:
- 1) long influence of big doses of poison;
  - 2) unitary influence of small doses of poison;
  - 3) inhalations of average doses of poison;
  - 4) unitary influence of big doses of poison;
  - 5) regular long influence of poison in small concentration.
- 6.** Acute professional poisoning arises after:
- 1) long influence of big doses of poison;
  - 2) unitary influence of small doses of poison;
  - 3) inhalations of average doses of poison;
  - 4) unitary influence of big doses of poison;
  - 5) regular long influence of poison in small concentration.
- 7.** Symptoms of acute poisoning by organic solvents are:
- 1) intoxication;
  - 2) infringement of coordination;
  - 3) drowsiness;
  - 4) nausea;
  - 5) spasms.
- 8.** Symptoms of chronic poisoning by mercury are:
- 1) dizzinesses;
  - 2) fast fatigue;
  - 3) emotional instability;
  - 4) depressive reactions;
  - 5) metal smack in mouth.
- 9.** Poisonings by beryllium are characterized by:
- 1) defeats of conjunctiva;
  - 2) defeat of lungs;
  - 3) fever;
  - 4) hearing defeat;

- 5) ataxia.
- 10.** Poisonings by lead are characterized by:
- 1) border on gums;
  - 2) reticulocytosis;
  - 3) polyneuritis;
  - 4) irritation of mucous;
  - 5) visual acuity decrease.
- 11.** Factors defining degree of toxicity of substance are:
- 1) concentration;
  - 2) chemical structure;
  - 3) aggregate state;
  - 4) period after action;
  - 5) time of action.
- 12.** Poisonings by hydrogen sulphide are characterized by:
- 1) irritation of mucous of top respiratory tracts;
  - 2) irritation of eyes mucous;
  - 3) defeat of lungs;
  - 4) gait infringement;
  - 5) visual acuity decrease.
- 13.** Prevention of professional poisonings includes actions:
- 1) organizational;
  - 2) treatment-prophylactic;
  - 3) usage of individual protection equipment;
  - 4) legislative;
  - 5) sanitary-engineering.
- 14.** Conditions of strengthening of poisons` toxic action are:
- 1) intensive physical work;
  - 2) high humidity of air;
  - 3) air heat;
  - 4) raised dust content;
  - 5) barometric pressure.
- 15.** Routes of exposure of toxins are:
- 1) inhalation;
  - 2) ingestion;
  - 3) injection and absorption through eyes and ear canals;
  - 4) absorption through the skin;
  - 5) bloodstream.

### Laboratory Work

- 1. Determine the content of nitrogen oxides (IV), ammonia, hydrogen sulphide, acetone, benzol and formaldehyde in air of a working zone.
- 2. Estimate the received results.
- 3. Investigate occupational poisoning and offer preventive actions.
- 4. Record the laboratory work report.

#### *Determination of content of acetone, benzol and formaldehyde in air of a working zone by gas chromatograph method.*

Equipment: gas chromatograph (figure 13), gas syringe.

Work performance:

- a. the hermetic gas syringe is filled with standard of the investigated substances and 1 mcl of it is quickly injected into a column of chromatograph;
- b. the gas syringe is filled with the investigated air and quickly injected it into a column;
- c. concentration of the investigated substances is determined by the chromatogram.



**Figure 13.** Gas chromatograph.

#### *Hygienic estimation.*

In air of a working zone of industrial enterprises maximum-permissible concentration of acetone is  $200 \text{ mg/m}^3$ , benzol -  $15 \text{ mg/m}^3$ , formaldehyde –  $0.5 \text{ mg/m}^3$ .



***Determination of content of nitrogen oxide (IV), ammonia, hydrogen sulphide in air of a working zone by express method.***

Equipment: gas analyzer YГ-1 (figure 14), indicator tubes, standard scales.

Work performance:

- a. the bellows are compressed by the rod;
- b. the indicator tube is connected to the rubber tube (preliminary it is necessary to brake off the sealed ends);
- c. the stopper is removed from the safety catch and air is passed through the indicator tube;
- d. the indicator tube is taken out and put to the scale, the top limit of color column shows on the scale the concentration of the defined substance in  $\text{mg}/\text{dm}^3$ .



**Figure 14.** Gas analyzer.

*Hygienic estimation.*

In air of a working zone of industrial enterprises maximum-permissible concentration of nitrogen oxide is  $2 \text{ mg}/\text{m}^3$ , ammonia -  $20 \text{ mg}/\text{m}^3$ , hydrogen sulphide –  $10 \text{ mg}/\text{m}^3$ .

**Solve a problem, estimate the obtained data and request actions for their improvement****Situational Task.**

In air of the reactor workshop 40 mg/m<sup>3</sup> of ammonia and 1.9 mg/m<sup>3</sup> of chlorine were found. Estimate the air in the workshop and offer actions for its improvement.

*The algorithm of task's solution:*

The chemical compound of air of the working zone mismatches to the hygienic requirements: ammonia content (maximum concentration limit is 20 mg/m<sup>3</sup>) and chlorine (maximum concentration limit is 1 mg/m<sup>3</sup>) are exceeded. It can lead to diseases of respiratory ways.

It is necessary to develop the improving actions including: technological – to introduce the closed technological processes and clearing of raw materials of impurity; planning – the sites with harmful substances should be placed near external walls and isolated; sanitary-engineering – to organize the rational ventilation in shop; organizational – to make workers` rational mode of work and rest. Concerning workers it is necessary to propose the treatment-prophylactic actions (periodic medical examination, physiotherapeutic procedures, sanatorium treatment, etc.). Workers should use the individual protection means of respiratory organs, eye and skin.

1. In air of the reactor workshop 30 mg/m<sup>3</sup> of ammonia and 1.5 mg/m<sup>3</sup> of chlorine were found. Estimate the air of the workshop and offer actions for its improvement.

2. In air of the mechanic workshop 38 mg/m<sup>3</sup> of chlorine and 10 mg/m<sup>3</sup> of benzol were found. Estimate the air of the workshop and offer actions for its improvement.

3. In air of the galvanic workshop 0.3 mg/m<sup>3</sup> of lead and 2 mg/m<sup>3</sup> of sulfuric acid were found. Estimate the air of the workshop and offer actions for its improvement

4. After welding works in closed premise of the mechanic workshop 0.8 mg/m<sup>3</sup> of manganese and 20 mg/m<sup>3</sup> of dust containing 70% of SiO<sub>2</sub> were found. Estimate the air of the workshop and offer actions for its improvement.

5. In air of the instrument assembly workshop 0.3 mg/m<sup>3</sup> of mercury and 7 mg/m<sup>3</sup> of HCl were found. Estimate the air of the workshop and offer actions for its improvement

6. In air of the television factory 0.1 mg/m<sup>3</sup> of lead and 25 mg/m<sup>3</sup> of

carbon oxide were found. Estimate the air of the workshop and offer actions for its improvement.

7. In air of the electronic shop equipment 0.01 mg/m<sup>3</sup> of beryllium and 300 mg/m<sup>3</sup> of formaldehyde were found. Estimate the air of the workshop and offer actions for its improvement.

8. In air of the paint shops benzene content is 15 mg/m<sup>3</sup>, caustic alkalis - 2 mg/m<sup>3</sup>. Estimate the air of the workshop and offer actions for its improvement.

9. In air of the brewery shop 7 mg/m<sup>3</sup> of methyl spirit and 1200 mg/m<sup>3</sup> of ethyl spirit were found. Estimate the air of the workshop and offer actions for its improvement.

10. In the poultry farm 40 mg/m<sup>3</sup> of ammonia and 25 mg/m<sup>3</sup> of hydrogen sulphide were found in air. Estimate the air of the workshop and offer actions for its improvement.

#### **The literature.**

1. Lecture 5.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 85-88.

**Laboratory classes № 16.**

**The topic: OCCUPATIONAL DISEASES CAUSED BY PSYCHO-PHYSIOLOGICAL AND BIOLOGICAL INDUSTRIAL FACTORS**

*The theme has important value for the further training at clinical departments, in practical work of a doctor for estimation of production factors and prevention of professional pathology.*

**Aim of the Lesson:** to be able to make the diagnostics, investigation and prevention of occupational diseases caused by psychophysiological and biological factors of industrial environment.

**Checking Questions.**

- ✓ 1. Professional pathology caused by weight of work.
- ✓ 2. Professional pathology caused by intensity of work.
- ✓ 3. Occupational diseases caused by biological production factors.
- ✓ 4. Prevention of professional pathology caused by psychophysiological production factors.
- ✓ 5. Prevention of professional pathology caused by biological production factors.
- ✓ 6. Methods of studying and estimation of psychophysiological and biological production factors.

**Multiple Choice Questions.**

**Choose proper answers**

1. Weight of work is a characteristic of labour process reflecting primary loading on:
  - 1) central nervous system;
  - 2) locomotorium;
  - 3) emotional sphere of workers;
  - 4) functional systems of organism;
  - 5) sense organs.
2. Intensity of work is a characteristic of labour process reflecting loading mainly on:
  - 1) central nervous system;
  - 2) locomotorium;
  - 3) emotional sphere of workers;
  - 4) functional systems of organism;
  - 5) sense organs.

- 3.** Weight of work is characterized by:
  - 1) physical dynamic loading;
  - 2) sensor loadings;
  - 3) working pose;
  - 4) monotony;
  - 5) static loading.
- 4.** Intensity of work is characterized by:
  - 1) intellectual loadings;
  - 2) quantity of stereotypic working class movements;
  - 3) emotional loadings;
  - 4) moving to space;
  - 5) work regimen.
- 5.** The dynamic work is subdivided on:
  - 1) general;
  - 2) regional;
  - 3) combined;
  - 4) peripheral;
  - 5) local.
- 6.** Work connected with expressed tension of locomotorium can lead to:
  - 1) neuritis;
  - 2) scoliosis;
  - 3) hemorrhoids;
  - 4) deformation of joints;
  - 5) chronic arthritises.
- 7.** Long work in sitting pose can lead to:
  - 1) constipation;
  - 2) infringement of menstrual cycle of women;
  - 3) chronic arthritises;
  - 4) lordosis;
  - 5) decrease of muscles tone.
- 8.** Diseases of tissue near joints are:
  - 1) asthenopia;
  - 2) deforming osteoarthritis;
  - 3) chronic arthritises;
  - 4) brachium-scapular periartrosis;
  - 5) neurodystrophic defeats of ligaments.
- 9.** Work connected with long stress of vision causes:
  - 1) asthenopia;
  - 2) photoelectric ophthalmia;

- 3) accommodation spasm;
  - 4) myopia;
  - 5) allergic conjunctivitis.
- 10.** Professional overstress of vocal apparatus is:
- 1) laryngitis;
  - 2) infringement of rhythm of vibration of vocal cords;
  - 3) muscular weakness;
  - 4) sight and hearing frustration;
  - 5) chronic tracheitis.
- 11.** Pathogenic microorganisms can cause:
- 1) tuberculosis;
  - 2) photoophthalmia;
  - 3) dermatitis;
  - 4) trichinosis;
  - 5) rabies.
- 12.** Symptoms at workers contacting with antibiotics are:
- 1) laryngitis;
  - 2) hands' tendinitis;
  - 3) functional frustration of central nervous;
  - 4) changes of peripheral blood;
  - 5) allergic diseases of breath organs.
- 13.** Prevention of harmful influence of weight and intensity of work is:
- 1) mechanization of manual operations;
  - 2) medical diets;
  - 3) correct arrangement of workplace;
  - 4) carrying out of industrial gymnastics;
  - 5) organization of preliminary and periodic medical inspections.
- 14.** Compelled pose at standing work can lead to:
- 1) hemorrhoids;
  - 2) phlebitis;
  - 3) platypodia;
  - 4) varicose veins;
  - 5) osteoporosis.
- 15.** Criteria of work classification by level of heaviness and intensity are:
- 1) power of the work;
  - 2) maximal weight;
  - 3) intensity of the attention;
  - 4) intensity of visual work;
  - 5) monotony.

**Laboratory Work.**

- 1. Determine weight and intensity of work, bacterial air pollution.
- 2. Estimate the received results.
- 3. Investigate the occupational disease and offer preventive actions.
- 4. Record the laboratory work report.

***Determination of weight and intensity of work.***

From table 1 it is necessary to choose the indicators characterizing intensity and weight of work of the worker.

**Table 1.** Classes of working conditions on indicators of labour process

Intensity indicators of labour process	Classes of working conditions			
	The optimum	The admissible	The harmful	
	1 class	2 class	3 class	
			1 degrees	2 degrees
1	2	3	4	5
1. Intellectual loadings				
1.1. The work maintenance	No necessity of decision-making	Decision of simple tasks by the instruction	Decision of difficult tasks with a choice by known algorithms	Creative activity, management in difficult situations
1.2. Character of performed work	Work to the individual plan	Work to the established schedule with its possible correction	Work in the conditions of time deficiency	Work in the conditions of time and information deficiency with the raised responsibility for an end result
2 Sensor loadings				
2.1. Duration of concentrated supervision (in % from all times of shift)	Up to 25	26-50	51-75	More than 75
2.2. Number of industrial objects of simultaneous supervision	Up to 5	6-10	11-25	More than 25
2.3. Loading on acoustic analyzer (at industrial necessity)	Legibility of words and signals from 100 % to 90 %. Difficulty is absent	Legibility of words and signals from 90 % to 70 %.	There is difficulty, speech is audible at distance 3,5 m	Legibility of words and signals from 70 % to 50 %. There is difficulty,

**Laboratory classes № 16. Occupational diseases caused by psychophysiological and biological industrial factors**

2.4. Loading on vocal apparatus (the total quantity of hours slandered per week)	Up to 16	16-20	20-25	More than 25
5. Regimen of work				
5.1. Work in shifts	One-shift work (without night shift)	Two-shift work (without night shift)	Two-shift with night shift, Three-shift work (work in night shift), daily watches	The irregular work in shifts with work at night

***Determination of bacterial air pollution.***

Equipment and reagents: slot-hole device of Krotove (figure 15), Petri dish, peptonic agar, counter of microbes' colonies, thermostat.

Work performance:

- a. open Petri dish with dense nutrient medium is established on rotating little table of Krotove device and closed the cover;
- b. investigated air is passed with 25 dm<sup>3</sup>/min speed in 2 mins;
- c. Petri dish is put in thermostat at 37°C for 48 hours;
- d. quantity of evolved colonies is counted;
- e. content of bacteria in air is counted according to the formula:

$$X = A \times 1000 / V_0,$$

where X - number of bacteria, CFU/m<sup>3</sup>,

A - number of evolved colonies at Petri dish,

V<sub>0</sub> - volume of the investigated air led to normal conditions, dm<sup>3</sup>.

***Hygienic estimation.***

Total amount of microorganisms in dressing room of surgical department before work must be no more than 500 CFU/m<sup>3</sup>, after work – 750 CFU/m<sup>3</sup>, in surgery block – 200 and 500 CFU/m<sup>3</sup>.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

Total microbial contamination of air of the livestock farm is 300000 CFU/m<sup>3</sup>. The milkmaids mark the staying in the compelled body position for more than 25% of the time shift, lifting and moving of loads constantly



during a work shift of more than 10 kg. Estimate the biological and psycho-physiological factors of the production environment and suggest the measures for their optimization.

*The algorithm of task's solution:*

Microbial aerosol of the livestock farm working area does not meet hygienic requirements: the total microbial contamination content is exceeded (normal value is 50000 CFU /m<sup>3</sup>). It can lead to various diseases. In accordance with the hygienic standard "Classes of working conditions in terms of the severity of the labor process" the milkmaids` working conditions are harmful of the 2 degree.

It is necessary to develop the treatment actions such as the health and disease control measures including a complex of sanitary, epidemiological and sanitary- veterinary activities: technological - to introduce the closed processes to reduce manual labor ; sanitary and technical - to organize the rational ventilation; organizational - to make the rational mode of work and rest for workers. Concerning workers it is necessary to propose the treatment-prophylactic actions (periodic medical examination, increase of resistance to pathogens, immunizations, sanatorium treatment, etc.). Workers must compulsory use the individual protection equipments of respiratory organs.



**Figure 15.** Slot-hole device of Krotove.

**1.** Total microbial contamination of air of the seeding microbiology laboratory is 1300 CFU/m<sup>3</sup> after work. The workers note the duration of concentrated observation more than 50% of the working day. Estimate the biological and psycho-physiological factors of the production environment and suggest the measures for their optimization.

**2.** Total microbial contamination of air of the infectious hospital treatment room is 750 CFU/m<sup>3</sup>. Estimate the biological and factors of the production environment and suggest the measures for their optimization.

**3.** The surgeon of Regional Hospital works in time and information deficiency conditions with increased responsibility for the final result and with the night time work. Estimate the psycho-physiological factors of the production environment and suggest the measures for their optimization.

**4.** The picker of the confectionery factory more than 60% of the time shift works in standing position. Estimate the psycho-physiological factors of the production environment and suggest the measures for their optimization.

**5.** Total microbial contamination of air of the scientific laboratory of the Department of Microbiology after experiments is 1500 CFU/m<sup>3</sup>. Estimate the biological factors of the production environment and suggest the measures for their optimization.

**6.** Total microbial contamination of air of the dressing cabinet of the surgical department is 800 CFU/m<sup>3</sup> after work, the nurse dressing up to 40% of the time shift is in standing position. Estimate the biological and psycho-physiological factors of the production environment and suggest the measures for their optimization.

**7.** Total microbial contamination of air of the operation room is 750 CFU/m<sup>3</sup> before operation. Estimate the biological factors of the production environment and suggest the measures for their optimization.

**8.** The head of Department of Research Institute carries the sole leadership in difficult situations, control and preliminary work on the distribution of tasks to others. Estimate the labor intensity and suggest measures for its optimization.

**9.** The teacher of Pedagogical University works according to the fixed schedule with a possible correction in the course of its activities, performs simple tasks according to instructions. Estimate the labor intensity and suggest measures for its optimization.

**10.** Total microbial contamination of air of the cattle farm is 320000 CFU/m<sup>3</sup>. Estimate the biological factors of the production environment and suggest the measures for their optimization.

**The literature.**

1. Lecture 5.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P.88-89.

**Laboratory classes № 17.**

**The topic: HYGIENE OF WORK IN SEPARATE INDUSTRIES AND AGRICULTURE**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for work estimation at industrial enterprises and prevention of professional pathology.*

**Aim of the Lesson:** to be able to assess the working conditions of industry and agriculture workers and to develop actions for their improvement.

**Checking Questions.**

- ✓ 1. Hygiene of work in pharmaceutical, radio-electronic industry and machine construction.
- ✓ 2. Hygiene of work in mining, building and oil-processing industry.
- ✓ 3. Hygiene of work in textile, clothing and shoemaking industries.
- ✓ 4. Hygiene of work in field of husbandry and animal industries.
- ✓ 5. Hygienic characteristic of pesticides and fertilizers.
- ✓ 6. Methods of studying and estimation of working conditions at industrial enterprises and in agriculture.

**Multiple Choice Questions.**

**Choose proper answers**

1. Basic adverse factors at work in field cropping are:
  - 1) cooling microclimate;
  - 2) dust, mineral fertilizers;
  - 3) noise, vibration presence;
  - 4) pesticides;
  - 5) intense working pose.
2. Adverse factors at work in animal industries are:
  - 1) compelled working pose;
  - 2) pollution of air environment;
  - 3) special microclimate;
  - 4) nervously emotional stress;
  - 5) rational regimen of day.
3. A pesticide is any substance or mixture of substance intended for:
  - 1) preventing any pest;
  - 2) repelling any pest;
  - 3) treating any pest;

- 4) destroying any pest;
- 5) mitigating any pest.
- 4.** A pesticide forms are:
  - 1) disinfectant;
  - 2) water;
  - 3) device;
  - 4) biological agent;
  - 5) plants.
- 5.** Pests forms are:
  - 1) microbes;
  - 2) nematodes;
  - 3) insects;
  - 4) fish;
  - 5) birds.
- 6.** Pesticides groups are:
  - 1) algicides;
  - 2) avicides;
  - 3) herbicides;
  - 4) insecticides;
  - 5) molluscicides.
- 7.** Mineral fertilizers are:
  - 1) substances containing one nutritious element;
  - 2) phosphoric;
  - 3) potassium;
  - 4) substances containing two and more nutritious element;
  - 5) nitrogen.
- 8.** Toxic chemicals in agriculture are:
  - 1) organophosphate;
  - 2) preparations of sulphur, arsenic and copper;
  - 3) organo-mercuric compound;
  - 4) organochlorine;
  - 5) derivatives of urea and phenol.
- 9.** Prevention of professional pathology in agriculture is:
  - 1) separate specialized storage of pesticides;
  - 2) special packing of toxic chemicals;
  - 3) rational operating time;
  - 4) usage of individual protective equipment;
  - 5) special transportation of chemicals and mineral fertilizers.
- 10.** Professional harm of pharmaceutical industry are:

- 1) harmful chemical substances;
  - 2) dust;
  - 3) noise;
  - 4) vibration;
  - 5) compelled working pose.
- 11. Professional harm of radio electronic industry are:**
- 1) high light exposure;
  - 2) small contrast of object of distinction with a background;
  - 3) presence in sight of direct and reflected brightness;
  - 4) frequent light readaptation of eyes;
  - 5) electromagnetic fields of radiofrequency ranges and static electricity.
- 12. Professional harm of mining industry are:**
- 1) special microclimatic conditions;
  - 2) dust;
  - 3) gases drug influence;
  - 4) vibration, noise;
  - 5) absence of daylight in underground conditions keeps danger of traumatism.
- 13. Professional harm in machine construction are:**
- 1) cooling microclimate;
  - 2) intensive noise, general and local vibration;
  - 3) ultrasound;
  - 4) harmful chemical substances;
  - 5) raised danger of industrial traumatism.
- 14. Professional harm in industry of building materials are:**
- 1) dust;
  - 2) heating up microclimate;
  - 3) air gassed condition;
  - 4) noise, vibration;
  - 5) physical and psychological overloads.
- 15. Professional harm at the textile and clothing enterprises are:**
- 1) dust, noise, vibration;
  - 2) adverse microclimatic conditions;
  - 3) pressure of visual and acoustical analyzers;
  - 4) high congestion industrial operations;
  - 5) absence of a constant workplace.

**Laboratory Work.**

- 1. Determine the level of individual working capacity and noise level at manufacture.

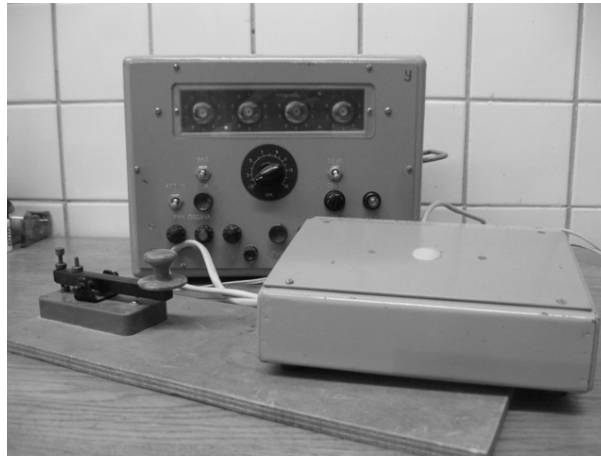
- 2. Estimate the received results.
- 3. Offer actions for improvement of working conditions.
- 4. Record the laboratory work report.

***Determination of visual and acoustical reaction.***

Equipment: universal chronoreflexometer (figure 16).

Work performance: Inspection of person is spent in dynamics of performed work.

- a. chronoreflexometer is switched on;
- b. the examiner presses a key at perception of signal submitted by the researcher;
- c. the result is read out from the decastrons;
- d. chronoreflexometer is switched off.



**Figure 16.** Universal chronoreflexometer.

***Hygienic estimation.***

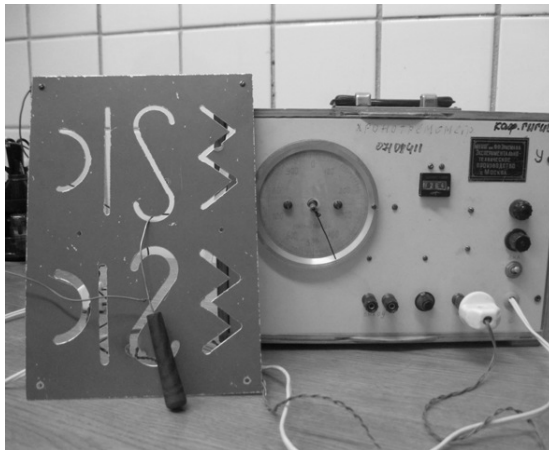
Development of lengthening of the latent period of reaction in comparison with initial level is marked at fatigue.

***Determination of delicate coordination of movement.***

Equipment: chronothremometer (figure 17).

Work performance: Difference of indications of the counter (final and initial) is estimated in dynamics (before and after work).

- a. chronothremometer is switched on;
- b. the examiner conducts by metal pointer through figured apertures of the panel, trying not to touch their walls;
- c. each contact of edges of apertures is registered by the device;
- d. chronothremometer is switched off.



**Figure 17.** Chronothremometer.

*Hygienic estimation.*

Increase of accuracy of movements testifies to working capacity improvement, fall - about fatigue approach.

*Determination of noise level indoors.*

Equipment and reagents: device for noise measurement (figure 18).

Work performance:

- a. the microphone is connected to the device which is switched on;
- b. the microphone is fixed in the place of measurement;
- c. switches are established on stable or pulse noise, total level or spectral structure;
- d. indications of pointer and positions of switches are recorded;
- e. the result of measurement is the sum of indications of switches and pointer.

*Hygienic estimation.*

The maximum permissible equivalent noise level on workplaces should be no more than 80 dBA.





**Figure 18.** Device for noise measurement.

**Solve a problem, estimate the obtained data and request actions for their improvement**

### **Situational Task.**

In air of the working area of the oil refining enterprise  $80 \text{ mg/m}^3$  of ammonia,  $105 \text{ mg/m}^3$  of hydrogen sulfide and  $65 \text{ mg/m}^3$  of carbon monoxide is found. Estimate the air of the working area and propose the measures to improve it.

*The algorithm of task's solution:*

The chemical composition of air of the working area does not meet the hygiene requirements: ammonia (MPC is  $20 \text{ mg/m}^3$ ), hydrogen sulfide (MPC is  $10 \text{ mg/m}^3$ ) and carbon monoxide (MPC is  $20 \text{ mg/m}^3$ ) concentrations are exceeded. It can lead to poisoning and diseases of top respiratory ways.

It is necessary to develop the treatment actions such as technological - to introduce the closed processes to reduce manual labor and cleaning of raw materials from impurities, planning - areas with discharge of harmful substances to place near exterior walls and insulate, sanitary and technical - to organize the rational ventilation; organizational - to make the rational mode of work and rest for workers. Concerning workers it is necessary to propose the treatment-prophylactic actions (periodic medical examination, increase of resistance to pathogens, immunizations, sanatorium treatment,

etc.). Workers must compulsorily use the individual protection means of respiratory organs, eyes and skin.

**1.** In the mechanic workshop temperature is 26°C (cold period of year), humidity is 85%, air movement rate is 0.2 m/s. Thermal radiation of the worker is 90 Wt/m<sup>2</sup>. Estimate the microclimate and offer actions for its improvement.

**2.** In the model workshop temperature is 17°C (cold period of year), humidity is 45%, air movement rate is 0.2 m/s. Thermal radiation of the worker is 70 Wt/m<sup>2</sup>. Estimate the microclimate and offer actions for its improvement.

**3.** In the assembly workshop where the high accuracy work is performed natural illumination factor is 1%, illumination with luminescent lamps is 250 lx. Estimate the illumination of the workshop and offer actions for its improvement.

**4.** In the mechanic workshop (high accuracy is not required) natural illumination factor is 0.5%, illumination with luminescent lamps is 100 lx. Estimate the illumination of the workshop and offer actions for its improvement.

**5.** In the premise of the poultry farm 40 mg/m<sup>3</sup> of ammonia и 25 mg/m<sup>3</sup> of hydrogen sulfide are revealed. Estimate the air of the working area and propose the measures to improve it.

**6.** In air of the working area of the plant on the production of plastics 60 mg/m<sup>3</sup> of ammonia и 55 mg/m<sup>3</sup> of hydrogen sulfide are revealed 55 мг/м<sup>3</sup>. Estimate the air of the working area and propose the measures to improve it.

**7.** Total microbial contamination of air of the livestock farm is 500000 CFU/m<sup>3</sup>. The milkmaids mark the staying in the compelled body position for more than 55% of the time shift, lifting and moving of loads constantly during a work shift of more than 15 kg. Estimate the biological and psycho-physiological factors of the production environment and suggest the measures for their optimization.

**8.** In the billet shop of the pharmaceutical company total microbial contamination of air is 900 CFU/m<sup>3</sup>. The workers control more than 20 of the production facilities of simultaneous observation. Estimate the biological and psycho-physiological factors of the production environment and suggest the measures for their optimization.

**9.** In the shoe shop in constant workplaces equivalent noise level is 93 dBA, at the geometric mean of 250 Hz is 92 dB, equivalent corrected level of local vibration on vibration speed is 85 dB, total vibration on vi-

bration acceleration is 55 dB. Estimate the physical factors of the production environment and suggest the measures for their optimization.

**10.** In the shop of the garment enterprise in constant workplaces equivalent noise level is 88 dBA, at the geometric mean of 1000 Hz is 80 dB, concentration of dust containing 10% of SiO<sub>2</sub> is 8 mg/m<sup>3</sup>. Estimate the physical factors and dust content of the production environment and suggest the measures for their optimization.

**The literature.**

1. Lecture 5.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 89-94.

**Laboratory classes № 18.****The topic: FINAL CONTROL STUDY OF CLASSES OF WORK HYGIENE**

*The theme has important meaning for further training at department of organization of public health services and public health, clinical departments, in practical work of a doctor.*

**Aim of the Lesson:** to be able to determine individual level of working capacity, weight and intensity of work, dust concentration in air, bacterial pollution, content of chemical substances in air of a working zone, noise level and vibrations, working conditions; to make diagnostics, investigation and prevention of occupational diseases and to propose actions for prevention of professional diseases and poisonings, for fatigue and overfatigue prevention, rationalization measures, preventing actions.

**Checking Questions.**

1. Hygienic characteristic of working conditions. Hygiene of work.
2. Professional diseases, they prevention and investigation.
3. Medical sanitary unit of enterprises, structure, tasks.
4. Health services of workers.
5. Organization and carrying out of medical inspections.
6. Occupational diseases caused by influence of noise, ultrasound, infrasound and their prevention.
7. Occupational diseases caused by vibration and their prevention.
8. Occupational diseases caused by influence of factors of microclimate, pressure and their prevention.
9. Occupational diseases caused by influence of ultra-violet, laser and ionizing radiations and their prevention.
10. Professional pathology caused by dust and their prevention.
11. Industrial poisons, classification. Receipt, distribution, metabolism and excretion of poisons. Influence of poisons on organism.
12. Toxicity and toxicologic hazard of industrial poisons. Toxicometry.
13. Occupational poisonings caused by influence of organic solvents, acids, alkalis, compound of nitrogen, sulphur and carbon.
14. Occupational poisonings caused by influence of chlorine, iodine, mercury, beryllium, lead, manganese, chrome.
15. Occupational poisoning prevention.
16. Professional pathology caused by weight of work.

17. Professional pathology caused by intensity of work.
18. Occupational diseases caused by biological production factors.
19. Prevention of professional pathology caused by psychophysiological production factors.
20. Prevention of professional pathology caused by biological production factors.
21. Hygiene of work in pharmaceutical, radio-electronic industry and machine construction.
22. Hygiene of work in mining, building and oil-processing industry.
23. Hygiene of work in textile, clothing and shoemaking industries.
24. Hygiene of work in the field of husbandry and animal industries.
25. Hygienic characteristic of pesticides and fertilizers.

### **Laboratory Work.**

#### **I. Determine parameters.**

1. Organize preliminary medical examination for the worker contacting with antibiotics.
2. Organize periodic medical examination for the worker contacting with industrial vibration.
3. Determine visual and acoustical reaction.
4. Determine delicate coordination of movements.
5. Determine weight and intensity of work.
6. Determine dust concentration in air of a working zone by automatic method.
7. Determine dust concentration in air of a working zone by weight method.
8. Determine thermal irradiation of workers.
9. Determine bacterial air pollution in air of a working zone.
10. Determine content of nitrogen oxide (IV), ammonia, hydrogen sulphide in air of a working zone by express method.
11. Determine content of acetone, benzene (benzol) and formaldehyde in air of a working zone by gas chromatograph method.
12. Determine noise level at manufacture.

#### **II. Estimate the received results.**

**III.** Offer actions for fatigue and overfatigue prevention, investigate professional disease (poisoning) and offer actions for its prevention.

#### **IV. Record the laboratory work report.**

### **The literature.**

1. Lecture 5.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 74-94.

**Laboratory classes № 19.****The topic: HYGIENIC REQUIREMENTS TO HOSPITAL ORGANIZATION'S PLANNING**

*The theme has important value for further training at department of organization of public health services and public health, therapy department, in practical work of a doctor for optimization of treatment-improving process and working conditions of personnel.*

**Aim of the Lesson:** to be able to assess planning and placement of hospitals and to propose actions for its rationalization.

**Checking Questions.**

- ✓ 1. The role of optimum lay-out and placement of hospitals. Hygienic requirements to choice and planning of hospital's ground area.
- ✓ 2. Systems of hospital's build-up. Features of modern hospital construction.
- ✓ 3. Features of lay-out of reception and pathoanatomical department of hospital.
- ✓ 4. Medical-diagnostic unit of hospital.
- ✓ 5. Hygienic requirements to surgery block lay-out.
- ✓ 6. Methods of studying and estimation of hospital's project.

**Multiple Choice Questions.****Choose proper answers**

1. Hygienic requirements to hospital ground area choice:
  - 1) territory should not be swamped and flooded by rivers, lakes, rain and melt waters;
  - 2) territory should be placed in the settle zone of the city;
  - 3) the area should be dry, on sandy or sabulous pure, safe soil;
  - 4) far from sources of noise and environmental contamination, railways, airports, high-speed highways;
  - 5) sanitary-protective zone should be 50-1000 m.
2. The proper level of subsoil waters is:
  - 1) 1.0 m from surface of soil;
  - 2) 1.5 m from surface of soil;
  - 3) 2.0 m from surface of soil;
  - 4) not less than 0.5 m from foundation base;
  - 5) not less than 1.3 m from foundation base.

- 3. Territory zones of a modern hospital are:**
  - 1) auxiliary buildings;
  - 2) medical buildings;
  - 3) not medical buildings;
  - 4) residential;
  - 5) landscape gardening.
- 4. Requirements to the hospital site:**
  - 1) area of green plantings should be 60 % or more;
  - 2) landscape gardening zone should be 25 m<sup>2</sup> per 1 bed;
  - 3) building area should be 15 % or less of total area;
  - 4) green plantings strip should be 15 m width into the perimeter of a hospital area;
  - 5) distance between medical building should be 24 m or more.
- 5. Systems of hospital build-up are:**
  - 1) combined;
  - 2) centralized;
  - 3) separate;
  - 4) decentralized;
  - 5) mixed.
- 6. Centralized system of hospital build-up:**
  - 1) all medical, medical-diagnostic and auxiliary departments of hospital are united in one building or in blocked building;
  - 2) different units are placed in separate buildings;
  - 3) basic somatic departments are placed in main medical building;
  - 4) infectious, maternity, children's, polyclinic, pathoanatomical departments and administrative unit are placed in separate buildings;
  - 5) surgical department and surgery block are placed separate from others.
- 7. Mixed system of hospital build-up:**
  - 1) all medical, medical-diagnostic and auxiliary departments of hospital are united in one building or in blocked building;
  - 2) different units are placed in separate buildings;
  - 3) basic somatic departments are placed in main medical building;
  - 4) infectious, maternity, children's, polyclinic, pathoanatomical departments and administrative unit are placed in separate buildings;
  - 5) surgical department and surgery block are placed separate from others.
- 8. Benefits of decentralized build-up system:**

- 1) all departments are well isolated;
  - 2) prevention of hospital-acquired infection;
  - 3) optimum conditions for medical-protective regimen;
  - 4) lengthening of all communications;
  - 5) duplication of some premises and equipment.
- 9.** Features of modern hospitals are:
- 1) new structural divisions;
  - 2) enlargement of hospitals;
  - 3) specialized hospitals;
  - 4) organization of hospitals by monoblocks system;
  - 5) large hospital complexes, hospital small towns and medical-diagnostic centers.
- 10.** Structural divisions of a hospital are:
- 1) reception;
  - 2) ward units;
  - 3) medical-diagnostic unit;
  - 4) therapeutical department;
  - 5) polyclinic.
- 11.** Functional groups of hospital's reception are:
- 1) anteroom;
  - 2) survey, sorting and medical aid rendering;
  - 3) diagnostic room;
  - 4) room for time isolation and supervision;
  - 5) auxiliary household.
- 12.** Medical-diagnostic unit of hospital is:
- 1) surgery block;
  - 2) department of regenerative treatment;
  - 3) department of functional diagnostics;
  - 4) anesthesiology;
  - 5) X-ray department.
- 13.** Zones of surgery block are:
- 1) sterile;
  - 2) zone of strict mode;
  - 3) zone of limited mode;
  - 4) zone of general hospital regimen;
  - 5) infected zone.
- 14.** A zone of strict mode of surgery block includes the following premises:
- 1) surgery room;



- 2) preoperative;
- 3) wardrobe of personnel;
- 4) equipment room;
- 5) postoperative wards with post of duty medical sister.

15. A zone of limited mode of surgery block includes the following premises:

- 1) preoperative;
- 2) premises for diagnostic researches;
- 3) sterilizing;
- 4) premises of surgeons and anesthesiologists;
- 5) gypsum room.

### **Laboratory Work.**

- 1. Lead examination of the hospital project (explanatory note, situational and general plans, working drawing of reception).
- 2. Estimate the received results.
- 3. Offer actions for rationalization of the hospital project.
- 4. Record the laboratory work report.

### ***Hygienic examination of the hospital's project.***

Equipment: rulers, pencils, project with explanatory note, situational plan, general plan, working drawings of reception, therapeutic, surgical departments, departments of polyclinic.

Work performance:

1) address of establishment, its capacity are found out from the explanatory note.

2) the following data is found out from the situational plan of hospital:

- sufficiency of breaks between hospital and nearest sources of pollution of atmospheric air, ground, water;

- location on winds rose;
- presence of road network;
- area incline.

3) the following data is found out from the general plan of hospital:

- size of site and areas;
- zones of site;
- percent of building and gardening;
- sites of building;
- economic constructions;

- water source, sanitary-technical objects;
- orientation of buildings.

4) internal lay out of the department, set of rooms, its interrelation and areas are found out from the working drawings of the department.

*Hygienic estimation.*

The received results are compared with SNaR 2.08.02-89 «Public buildings and constructions. Norms of designing».

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

On the general plan of the hospital on 1000 beds (mixed build-up system) the total hospital area is 5 hectares, including 40 % of green plantings, 30 % of buildings. There are the main hospital building, infectious building, polyclinic, pathological-anatomy department, and engineering building on the hospital territory. 3 entrances are planned. The distance between somatic, infectious and engineering building is 23 m. Estimate the general plan of the hospital and offer actions for its improvement.

*The algorithm of task's solution:*

The general plan of the hospital doesn't conform to the hygienic requirements: the total hospital area is insufficient (the proper size is 10,5 hectares), the gardening area (the proper size is 60 %), the building area (the proper size is 13-15 %), the distance between buildings (the proper size is 25 m) are insufficient too.

It is necessary to increase the total hospital area, to increase the gardening area, to reduce the building area, to increase the distance between buildings.

**1.** The reception of the hospital on 500 beds (mixed build-up system) consists of lobby, registry, duty doctor office, toilets for the personnel and patients, clothing-room and sanitary premises. All the patients (adults and children) are examined in the same ward. Estimate the lay-out of the reception and offer actions for its improvement.

**2.** On the project of the ward unit there are wards for patients, patients' day room, glazed verandah, doctors lounge, treatment room, dressing ward, corridor. Estimate the project of the ward unit and offer actions for its improvement.

**3.** On the general plan of the hospital on 800 beds (mixed build-up system) the total hospital area is 3 hectares, including 30 % of green plantings, 40 % of buildings. There are main hospital building, infectious building, polyclinic, pathological-anatomy department and engineering building on the hospital territory. 2 entrances are planned. The distance between somatic, infectious and engineering building is 15 m. Estimate the general plan of the hospital and offer actions for its improvement.

**4.** On the general plan of the hospital on 400 beds (mixed build-up system) the total hospital area is 1 hectares, including 20 % of green plantings, 50 % of buildings. There are main hospital building, infectious building, polyclinic, pathological-anatomy department, and engineering building on the hospital territory. 1 entrance is planned. The distance between somatic, infectious and engineering building is 25 m. Estimate the general plan of the hospital and offer actions for its improvement.

**5.** The operational block of the hospital has septic and aseptic unit. Block premises are divided into sterile zone, zone of the limited mode and zone of the general mode. The parity septic and aseptic operation rooms is 1:4. The area of general surgery operation room is 28 m<sup>2</sup>, traumatologic - 38 m<sup>2</sup>. The operational block is located on the ground floor of the main hospital building. Estimate the project of the operational block unit and offer actions for its improvement.

**6.** On the general plan of the hospital on 100 beds (centralized build-up system) the total hospital area is 1.5 hectares, including 35 % of green plantings, 40 % of buildings. There are main hospital building and engineering building on the hospital territory. 1 entrance is planned. The distance between medical and engineering building is 15 m. Estimate the general plan of the hospital and offer actions for its improvement.

**7.** On the general plan of the hospital on 600 beds (centralized build-up system) the total hospital area is 4.0 hectares, including 50 % of green plantings, 40 % of buildings. There are main hospital building, infectious building, pathological-anatomy department and engineering building on the hospital territory. 1 entrance is planned. The distance between somatic, infectious and engineering building is 15 m. Estimate the general plan of the hospital and offer actions for its improvement.

**8.** The reception of the hospital on 400 beds consists of lobby, registry, duty doctor office, urgent lab, treatment room, clothing-room and sanitary premises. All the patients (adults and children) are examined in the same ward. Estimate the lay-out of the reception and offer actions for its improvement.

**9.** The reception of the hospital on 400 beds (mixed build-up system) consists of lobby, registry, duty doctor office, toilets for the personnel and patients, clothing-room, and sanitary premises. All the patients (adults and children) are examined in the same ward. Estimate the lay-out of the reception and offer actions for its improvement.

**10.** On the general plan of the hospital on 600 beds (mixed build-up system) the total hospital area is 3 hectares, including 30 % of green plantings, 40 % of buildings. There are main hospital building, infectious building, polyclinic, pathological-anatomy department and engineering building on the hospital territory. 2 entrances are planned. The distance between somatic, infectious and engineering building is 15 m. Estimate the general plan of the hospital and offer actions for its improvement.

**The literature.**

1. Lecture № 6.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 97–100, 106-109.

**Laboratory classes № 20.**

**The topic: HYGIENIC REQUIREMENTS TO PLANNING OF HOSPITAL'S WARD DEPARTMENTS**

*The theme has important value for further training at department of organization of public health services and public health, therapy department, in practical work of a doctor for optimization of treatment-improving process and working conditions of personnel, prevention of hospital-acquired infections.*

**Aim of the Lesson:** to be able to assess lay-out of hospital's ward departments and to propose actions for its improvement.

**Checking Questions.**

- ✓ 1. Hygienic requirements to ward section.
- ✓ 2. Features of therapeutic and surgical department's planning.
- ✓ 3. Features of obstetric and gynecologic department's planning.
- ✓ 4. Features of infectious and children department's planning.
- ✓ 5. Features of planning and work regimen of radiological department.
- ✓ 6. Methods of studying and estimation of hospital's planning.

**Multiple Choice Questions.**

**Choose proper answers**

1. Types of therapeutics departments are:
  - 1) cardiological;
  - 2) rheumatological;
  - 3) urological;
  - 4) neurologic;
  - 5) gastroenterological.
2. Types of surgical departments are:
  - 1) chest (thoracic) surgery;
  - 2) orthopedical;
  - 3) casualty (traumatology);
  - 4) hematological;
  - 5) urological.
3. Septic departments of surgery are meant for:
  - 1) patients with infectious diseases;
  - 2) patients which are free from contamination caused by harmful bacteria, viruses, or other microorganisms;

- 3) children;
  - 4) patients with purulent inflammations;
  - 5) pregnant women.
- 4.** Aseptic departments of surgery are meant for:
- 1) pregnant women;
  - 2) patients with purulent inflammations;
  - 3) children;
  - 4) patients which are free from contamination caused by harmful bacteria, viruses, or other microorganisms;
  - 5) patients with infectious diseases.
- 5.** Obstetric unit includes:
- 1) obstetric physiological department;
  - 2) septic department;
  - 3) pathologic pregnancy department;
  - 4) postnatal physiological department;
  - 5) observational department.
- 6.** An obstetric physiological department is meant for:
- 1) pregnant women stay before childbirth, and for delivering a child;
  - 2) pregnant women with some abnormalities of pregnancy;
  - 3) women recently confined;
  - 4) pregnant women with infections;
  - 5) newborn children.
- 7.** A pathologic pregnancy department is meant for:
- 1) pregnant women stay before childbirth, and for delivering a child;
  - 2) pregnant women with some abnormalities of pregnancy;
  - 3) women recently confined;
  - 4) pregnant women with infections;
  - 5) newborn children.
- 8.** A postnatal physiological department is meant for:
- 1) pregnant women stay before childbirth, and for delivering a child;
  - 2) pregnant women with some abnormalities of pregnancy;
  - 3) women recently confined;
  - 4) pregnant women with infections;
  - 5) newborn children.
- 9.** An observational department is meant for:
- 1) pregnant women stay before childbirth, and for delivering a child;
  - 2) pregnant women with some abnormalities of pregnancy;
  - 3) women recently confined;
  - 4) pregnant women with infections;

5) newborn children.

**10.** Usually an obstetric physiological department consists of:

- 1) predelivery room;
- 2) delivery room (12 bedded);
- 3) treatment room;
- 4) minor operating room;
- 5) postoperative (recovery) ward.

**11.** Usually a postnatal physiological department consists of:

- 1) 12-bedded wards for women;
- 2) wards for women with beds for newborns;
- 3) delivery room (12-bedded);
- 4) treatment room;
- 5) 20-bedded nursery.

**12.** An observational department usually includes:

- 1) delivery rooms;
- 2) delivery isolation ward;
- 3) postnatal wards;
- 4) wards for newborns;
- 5) delivery room (23-bedded).

**13.** Gynecology department includes:

- 1) admission room;
- 2) ward section;
- 3) surgery room;
- 4) intensive therapy room;
- 5) postoperative (recovery) ward.

**14.** Structure of radiological department is:

- 1) premises for medical application of closed sources of radiation;
- 2) premises for open sources of radiation;
- 3) premises for distance radiation therapy;
- 4) premises for radio isotope diagnostics;
- 5) medical-auxiliary.

**15.** Boxes structure is:

- 1) sluice;
- 2) wards;
- 3) entrance platform;
- 4) bathroom;
- 5) buffet.

### **Laboratory Work.**

- 1. Lead examination of working drawings of ward departments.
- 2. Estimate the received results.
- 3. Offer actions for improvement of department's planning.
- 4. Record the laboratory work report.

#### ***Hygienic examination of hospital's project.***

Equipment: rulers, pencils, working drawings of departments.

Work performance: internal planning of the department, set of rooms, its interrelation and areas are found out from the working drawings of the department.

#### ***Hygienic estimation.***

The received results are compared with SNaR 2.08.02-89 «Public buildings and constructions. Norms of designing».

### **Solve a problem, estimate the obtained data and request actions for their improvement**

#### **Situational Task.**

In the projected therapeutic department there are two ward sections including wars for patients and general premises: doctors' lounge, treatment room, toilets for patients and personnel, and pantry. Estimate the project of the therapeutic department and offer actions for its improvement.

#### ***The algorithm of task's solution:***

Planning of the therapeutic department doesn't conform to the hygienic requirements: some general premises are absent, namely: a managing office, a head nurse's office, a post of duty nurse, an enema room, a bath-room, a patients' day room, a dining room, premises for dirty and pure linen storage, and a room for personnel.

It is necessary to add the absent premises to the project.

**1.** In the project of the therapeutic department there are one 1-bedded ward without sluice (6 m<sup>2</sup>), two 2-bedded wards (12 m<sup>2</sup>), six 3-bedded wards (20 m<sup>2</sup>) and one 6-bedded ward (30 m<sup>2</sup>), post of duty nurse, managing office, treatment room and still-room. Estimate the project of the therapeutic department and offer actions for its improvement.

**2.** The ward section for adult somatic patients is 35-bedded. There is one 1-bedded ward (8 m<sup>2</sup>) and one 2-bedded ward (12 m<sup>2</sup>). The others ones



are 3-6-bedded ( $6 \text{ m}^2$  per one bed). There is also doctor's lounge, post of duty nurse, treatment room, and lobby for day stay of patients. Estimate the project of the ward unit and offer actions for its improvement.

**3.** The ward section for adult somatic patients is 30-bedded. There are two 2-bedded wards ( $14 \text{ m}^2$ ). The others ones are 4-5-bedded ( $6-7 \text{ m}^2$  per one bed). There is also treatment room, enema room, managing office, dining room and stillroom. Estimate the project of the ward unit and offer actions for its improvement.

**4.** In the infectious hospital in the boxed branch for adults 15 % of beds is located in 1-bedded isolating rooms ( $18 \text{ m}^2$ ), the others ones - in 2-bedded boxes ( $22 \text{ m}^2$ ). The discharge from the hospital is carried out through the general corridor and sanitary room. Estimate the project of the ward unit and offer actions for its improvement.

**5.** In the infectious hospital in branch for children from 0 till 3th years 50% of beds is placed in boxes. The others ones are in half-boxes. The area of 2-bedded boxes is  $20 \text{ m}^2$ . The area of half-boxes does not exceed  $5 \text{ m}^2$  per 1 bed. Estimate the project of the ward unit and offer actions for its improvement.

**6.** In the project of the therapeutic department there are two 1-bedded wards ( $8 \text{ m}^2$ ), three 2-bedded wards ( $10 \text{ m}^2$ ), five 3-bedded wards ( $15 \text{ m}^2$ ) and two 6-bedded wards ( $30 \text{ m}^2$ ), post of duty nurse, managing office, treatment room, enema room and still-room. Estimate the project of the therapeutic department and offer actions for its improvement.

**7.** The ward section for adult somatic patients is 40-bedded. There is one 1-bedded ward ( $6 \text{ m}^2$ ) and three 2-bedded wards ( $12 \text{ m}^2$ ). The others ones are 3-6-bedded ( $7 \text{ m}^2$  per one bed). There is also doctor's lounge, post of duty nurse, treatment room and dining room. Estimate the project of the ward unit and offer actions for its improvement.

**8.** In the infectious hospital in the boxed branch for adults 15 % of beds is located in 1-bedded isolating rooms ( $18 \text{ m}^2$ ), the others ones - in 2-bedded boxes ( $22 \text{ m}^2$ ). The discharge from the hospital is carried out through the general corridor and sanitary room. Estimate the project of the ward unit and offer actions for its improvement.

**9.** The ward section for adult somatic patients is 30-bedded. There are two 2-bedded wards ( $14 \text{ m}^2$ ). The others ones are 4-5-bedded ( $6-7 \text{ m}^2$  per one bed). There is also treatment room, enema room, managing office, dining room and stillroom. Estimate the project of the ward unit and offer actions for its improvement.

**10.** In the infectious hospital in branch for children from 0 till 3th

years 50% of beds is placed in boxes. The others ones are in half-boxes. The area of 2-bedded boxes is 20 m<sup>2</sup>. The area of half-boxes does not exceed 5 m<sup>2</sup> per 1 bed. Estimate the project of the ward unit and offer actions for its improvement.

**The literature.**

1. Lecture № 6.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 100-105.

**Laboratory classes № 21.****The topic: HYGIENIC CHARACTERISTIC OF HEATING AND VENTILATION OF HOSPITALS**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for optimization of medical-improving process and personnel working conditions.*

**Aim of the Lesson:** to be able to assess ventilation, heating and microclimate of hospital's premises and to propose actions for their rationalization.

**Checking Questions.**

- ✓ 1. Hospital's heating and ventilation, its hygienic meaning.
- ✓ 2. Hygienic requirements to hospital's heating.
- ✓ 3. Hygienic requirements to hospital's ventilation.
- ✓ 4. Air conditioning in hospital's premises.
- ✓ 5. Microclimate of hospitals and its hygienic value. Joint influence of microclimate factors.
- ✓ 6. Methods of studying and estimation of ventilation, heating and microclimate.

**Multiple Choice Questions.****Choose proper answers**

1. Types of local heating are:
  - 1) gas heating;
  - 2) hot-air heating;
  - 3) stove heating;
  - 4) electric heating;
  - 5) radiant heating.
2. Hygienic requirements to heating:
  - 1) should be sufficient;
  - 2) should be regulated;
  - 3) should be uniform;
  - 4) should be safe;
  - 5) should be silent.
3. Types of central heating are:
  - 1) steam heating;
  - 2) hot-air heating;
  - 3) stove heating;

- 4) water heating;
- 5) radiant heating.
4. Ventilation according to a way of air moving can be:
  - 1) exhaust;
  - 2) natural;
  - 3) mechanical;
  - 4) general;
  - 5) forced.
5. Ventilation according to away of giving and removal can be:
  - 1) exhaust;
  - 2) natural;
  - 3) forced and exhaust;
  - 4) general;
  - 5) forced.
6. Ventilation according to a destination can be:
  - 1) local;
  - 2) natural;
  - 3) forced and mechanical;
  - 4) general;
  - 5) forced.
7. Features of mechanical ventilation are:
  - 1) big radius of action;
  - 2) small radius of action;
  - 3) considerable speed in air lines;
  - 4) low speed in air lines;
  - 5) independence of inflow and extract from temperature of external air and wind speed.
8. Hygienic requirements to ventilation:
  - 1) should exclude receipt of air from «dirty» premises in «pure»;
  - 2) should delete polluted air completely;
  - 3) should fan enough of pure air;
  - 4) should be silent;
  - 5) should be safe.
9. Sanitary indicators of air cleanliness in a hospital are:
  - 1) absence of smell;
  - 2) content of carbon dioxide is no more than 0.7-1 %;
  - 3) content of carbon dioxide is no more than 15 %;
  - 4) oxidability of air is no more than 1-3 mg/m<sup>3</sup> of oxygen;
  - 5) oxidability of air is no more than 5-6 mg/m<sup>3</sup> of oxygen.

**10.** Influence of heating up microclimate on patients is:

- 1) skin temperature raises;
- 2) water-salt exchange is broken;
- 3) organism dehydration occurs;
- 4) loss of mineral salts and water-soluble vitamins;
- 5) activity of cardiovascular, respiratory and other systems changes.

**11.** Influence of cooling microclimate on patients is:

- 1) vasomotor spasms;
- 2) skin temperature raises;
- 3) organism dehydration occurs;
- 4) freezing injuries;
- 5) catarrhal diseases.

**12.** The proper temperature in wards is:

- 1) 15-18°C in winter;
- 2) 18-21°C in winter;
- 3) 22-25°C in winter;
- 4) up to 30° C in summer;
- 5) up to 24°C in summer.

**13.** The proper microclimate regimen in wards is:

- 1) relative humidity is 55-60 %;
- 2) relative humidity is 60-65 %;
- 3) relative humidity is 65-70 %;
- 4) speed of air motion is not above 0.15 m/s;
- 5) speed of air motion is not above 0.3 m/s.

**14.** Thermolysis is carried out by means of:

- 1) conducting;
- 2) melting;
- 3) drying;
- 4) radiation;
- 5) evaporation.

**15.** Conditioners functions are:

- 1) heats up or cool of air;
- 2) humidify or dry of air;
- 3) clear of dust;
- 4) deodorize of air;
- 5) ionize of air.

### Laboratory Work.

- 1. Determine the necessary volume of ventilation, ventilation rate, wall temperature and heating devices temperature in hospital.
- 2. Estimate the received results.
- 3. Offer actions for improvement of heating, ventilation and microclimate in hospital.
- 4. Record the laboratory work report.

#### *Determination of the necessary ventilation volume.*

Equipment: gas chromatograph, gas syringe.

Work performance:

- a. the hermetic gas syringe is filled with carbon dioxide standard, 1 mkl of it is quickly injected into the column of chromatograph;
- b. the gas syringe is filled with the tested air and quickly injected it into the column;
- c. the carbon dioxide concentration is calculated with the chromatogram;
- d. the necessary volume of ventilation is counted according to the formula:

$$L = K \times n / (P - 0.4),$$

where L - necessary ventilation volume, m<sup>3</sup>/h;

K - quantity of carbon dioxide, exhaled by a person during easy physical work within 1 h (22.6 dm<sup>3</sup>);

n - number of people indoor;

P - content of carbon dioxide indoor, ‰;

0.4 - content of carbon dioxide in the atmospheric air, ‰.

#### *Hygienic estimation.*

The necessary ventilation volume must be not less than 37.7 m<sup>3</sup>/h per 1 person, 80 m<sup>3</sup>/h per 1 patient in hospitals.

#### *Determination of ventilation rate.*

Equipment: anemometer AP-1, ruler, roulette.

Work performance:

- a. anemometer is perpendicularly placed to air currents direction in the ventilating aperture;
- b. the device is switched on and the data from the screen is read in 30 sec;

- c. the sectional area of ventilating aperture is measured;  
d. the volume of remove or arrive air is calculated under the formula:  
la:

$$Q = V \times b \times 3600,$$

where Q - required quantity of air, m<sup>3</sup>;

V - air movement speed in the ventilating aperture, m/s;

b - sectional area of the ventilating aperture, m<sup>2</sup>;

3600 - factor for recalculation of hour per seconds.

- e. length, height and width of the premise are measured and its volume in m<sup>3</sup> is calculated;  
f. the ventilation rate is calculated under the formula:

$$P = Q / K,$$

where Q - volume of remove or arrive air, m<sup>3</sup>/h;

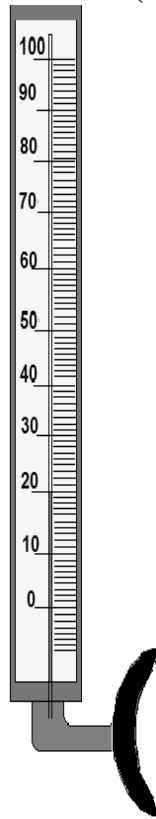
K – premise's volume, m<sup>3</sup>.

#### *Hygienic estimation.*

The ventilation rate must be +10-5 in surgery block.

#### *Determination of wall temperature.*

Equipment and reagents: wall thermometer (figure 19), adhesive plaster.



**Figure 19.** Wall thermometer.

Work performance:

- a. the thermometer ball is fixed to the investigated place of the wall with adhesive plaster;
- b. the thermometer ball is covered with cotton wool;
- c. the readings is taken in 3 minutes.

*Hygienic estimation.*

The wall temperature must not differ from the air temperature more than  $6^{\circ}\text{C}$ .

*Determination of heating devises temperature.*

Equipment: wall thermometer, adhesive plaster.

Work performance:

- a. the thermometer ball is fixed to the investigated place of the heating devise with adhesive plaster;
- b. the thermometer ball is covered with cotton wool;
- c. the readings is taken in 3 minutes.

*Hygienic estimation.*

The temperature of heating devises must not exceed  $80^{\circ}\text{C}$ .

**Solve a problem, estimate the obtained data and request actions for their improvement****Situational Task.**

In the ward for adult patients average temperature of air during winter time is  $15^{\circ}\text{C}$ , temperature of external wall -  $11^{\circ}\text{C}$ , temperature's difference on vertical -  $3^{\circ}\text{C}$ , on horisontal -  $6^{\circ}\text{C}$ , relative humidity - 85 %, speed of air movement - 0,4 m/s. Estimate the microclimatic conditions in the ward and offer improvement actions.

*The algorithm of task's solution:*

The ward microclimate not corresponds to the hygienic requirements: temperature is lowered (normal is  $19-21^{\circ}\text{C}$ ), temperature's difference between the external wall and air is increased (normal is  $5^{\circ}\text{C}$ ), temperature's difference on vertical is increased (normal is  $1^{\circ}\text{C}$  on 1 m of height) and on horisontal (normal is  $2^{\circ}\text{C}$ ), relative humidity is raised (normal 55-60 %), speed of air movement is raised (normal is 0.15 m/s). Thus, microclimate in the ward is cooling.

For the microclimate optimization in the ward it is necessary to warm



windows, to adjust effective system of heating and ventilation.

**1.** In the ward for adult patients average temperature of air during summer time is 27°C, temperature of external wall - 20°C, temperature's difference on vertical - 2°C, on horizontal - 3°C, relative humidity - 75 %, speed of air movement – 0.05 m/s. Estimate the microclimate in the ward and offer improvement actions.

**2.** In the ward for adult patients average temperature of air during the winter period is 18°C, relative humidity - 65 %, speed of air movement – 0.2 m/s, content of CO<sub>2</sub> – 0.8 ‰, oxidability - 4 mg of oxygen per m<sup>3</sup>. Estimate the microclimate and air pollution in the ward and offer improvement actions.

**3.** In the ward for adult patients average temperature of air during summer time is 21°C, relative humidity - 40 %, speed of air movement – 0.15 m/s, content of CO<sub>2</sub> - 1 ‰, oxidability - 6 mg of oxygen per m<sup>3</sup>, general microbic number of air - 5000 CFU/m<sup>3</sup>. Estimate the microclimate, microbic and air pollution in the ward and offer improvement actions.

**4.** In the surgery block temperature of air is 26°C, relative humidity - 30 %, speed of air movement – 0.01 m/s, content of CO<sub>2</sub> – 1.1 ‰, oxidability - 3 mg of oxygen per m<sup>3</sup>. Estimate the microclimate and air pollution in the surgery block and offer improvement actions.

**5.** In the doctor's office average temperature of air is 28°C during summer time, relative humidity - 30 %, speed of air movement – 0.05 m/s, content of CO<sub>2</sub> - 1 ‰, general microbic number of air - 9000 CFU/m<sup>3</sup>. Estimate the microclimate, microbic and air pollution in the doctor's office and offer improvement actions.

**6.** In the surgery block temperature of air is 26°C, speed of air movement – 0.01 m/s, general microbic number of air after operation - 3200 CFU/m<sup>3</sup>, ventilation rate is +3-4. Estimate the microclimate and microbic pollution in the surgery block and offer improvement actions.

**7.** In the postoperative wards temperature of air is 16°C, speed of air movement – 0.4 m/s, general microbic number of air - 5100 CFU/m<sup>3</sup>, ventilation rate is +1-1, quantity of staphilococci is 1 in 250 l of air. Estimate the microclimate and microbic pollution in the postoperative wards and offer improvement actions.

**8.** In the obstetric physiological department general microbic number of air - 2000 CFU/m<sup>3</sup>, ventilation rate is +1-1.5, quantity of staphilococci is 1 in 250 l of air. Estimate the microclimate and microbic pollution in the obstetric physiological department and offer improvement actions.

**9.** In the boxes of infectious departments the necessary volume of ventilation is 30 m<sup>3</sup>/h per 1 person, quantity of staphilococci is 5 in 250 l of air, general microbic number of air - 6500 CFU/m<sup>3</sup>, content of CO<sub>2</sub> – 1.1 ‰. Estimate the microclimate, microbic and air pollution in the boxes and offer improvement actions.

**10.** In the ward for newborns average temperature of air is 30°C during summer time, relative humidity - 80 %, speed of air movement – 0.05 m/s, content of CO<sub>2</sub> - 1 ‰, oxidability - 4 mg of oxygen per m<sup>3</sup>, general microbic number of air - 6000 CFU/m<sup>3</sup>. Estimate the microclimate, air and microbic pollution in the boxes and offer improvement actions.

### **The literature.**

1. Lecture № 6.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 111-115.

**Laboratory classes № 22.**

**The topic: HYGIENIC CHARACTERISTIC OF ILLUMINATION  
AND WATER SUPPLY OF HOSPITALS**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for optimization of medical-improving process and personnel working conditions.*

**Aim of the Lesson:** to be able to assess illumination and water supply of hospital's premises and to propose actions for its improvement.

**Checking Questions.**

- ✓ 1. Illumination and water supply of hospitals, its hygienic value.
- ✓ 2. Hygienic requirements to natural illumination of hospital's premises.
- ✓ 3. Hygienic requirements to artificial illumination of hospital's premises. Light sources and types of lamps, its hygienic estimation.
- ✓ 4. Hygienic requirements to water quality in hospitals.
- ✓ 5. Hygienic requirements to water supply of hospitals.
- ✓ 6. Methods of studying and estimation of illumination and water supply in hospitals.

**Multiple Choice Questions.**

**Choose proper answers**

1. Types of illumination are:
  - 1) natural;
  - 2) strict;
  - 3) artificial;
  - 4) electric;
  - 5) radiant.
2. Hygienic requirements to natural illumination:
  - 1) should be sufficient;
  - 2) should be regulated;
  - 3) should be equal;
  - 4) should be steady;
  - 5) should be not blinding.
3. Types of artificial illumination system are:
  - 1) general;
  - 2) mechanical;
  - 3) combined;

- 4) reflected;
- 5) local.
- 4.** Natural illumination depends on:
  - 1) sizes of light apertures;
  - 2) orientations of windows in relation to parts of world;
  - 3) speed of air movement;
  - 4) cleanliness of glasses;
  - 5) presence of curtains.
- 5.** Only artificial illumination is supposed in hospital premises:
  - 1) baths;
  - 2) ward for adult patients;
  - 3) narcotic room;
  - 4) preoperative and surgical;
  - 5) shower and wardrobe for personnel.
- 6.** Rational illumination functions:
  - 1) increases blood pressure;
  - 2) increases working capacity;
  - 3) promotes best sanitary maintenance of premises;
  - 4) raises person's vitality;
  - 5) improves visual function.
- 7.** Hygienic requirements to artificial illumination:
  - 1) should be sufficient;
  - 2) spectrum of it is nearer to natural;
  - 3) should be uniform;
  - 4) should be steady;
  - 5) should be not blinding.
- 8.** In wards for adult patient should be:
  - 1) natural illumination factor 1 %;
  - 2) light factor 1/5-1/6;
  - 3) light factor 1/7-1/8;
  - 4) aperture angle not less 5°;
  - 5) aperture angle not less 15°.
- 9.** The arriving in hospital water should be:
  - 1) colourless;
  - 2) of natural chemical compound;
  - 3) transparent;
  - 4) free of toxic chemical and radioactive substances, pathogenic micro-organisms, cysts of Protozoa and helminthes eggs;
  - 5) smell free.

**10.** In wards for children should be:

- 1) angle of light incidence not less  $37^\circ$ ;
- 2) natural illumination factor 1.8 %;
- 3) angle of light incidence not less  $27^\circ$ ;
- 4) aperture angle not less  $5^\circ$ ;
- 5) light factor 1/5-1/6.

**11.** Types of water supply system of a hospital are:

- 1) general;
- 2) centralized;
- 3) combined;
- 4) decentralized;
- 5) local.

**12.** Consumption of water in hospitals:

- 1) on 1 somatic bed makes 250-400 dm<sup>3</sup>;
- 2) on 1 somatic bed makes 150-200 dm<sup>3</sup>;
- 3) on 1 outpatient reception hours makes 15 dm<sup>3</sup>;
- 4) in rural hospitals on 1 bed makes 100-150 dm<sup>3</sup>;
- 5) on 1 somatic bed makes 15-35 dm<sup>3</sup>.

**13.** Hygienic requirements to water quality in hospitals:

- 1) should be colourless;
- 2) should be transparent;
- 3) should possess pleasant freshening taste;
- 4) should have a natural chemical compound;
- 5) should not contain toxic chemical and radioactive substances, pathogenic microorganisms, helminthes eggs.

**14.** Distance between light ruptures should not exceed:

- 1) 50-1000 m;
- 2) 100-300 m;
- 3) 24 m;
- 4) 10 m;
- 5) 35 m.

**15.** The best windows orientation providing sufficient light exposure is:

- 1) southern for hospital wards;
- 2) northern for surgical block;
- 3) southern for rooms of day stay;
- 4) northern for boxes;
- 5) southern for bathroom.

### **Laboratory Work.**

- 1. Determine light factor, factor of natural illumination, light incidence and aperture corner, horizontal illumination intensity by objective and calculation method, water supply quality in hospital.
- 2. Estimate the received results.
- 3. Offer actions for improvement of illumination and water supply in the hospital.
- 4. Record the laboratory work report.

#### ***Determination of light factor indoors.***

Equipment: ruler, roulette.

Work performance:

- a. area of glazed surface of windows and floor area are measured;
- b. light factor – is a relation of unit to quotient (division of floor area on area of glazed surface of windows) is calculated under the formula:

$$\mathbf{LF = 1: (S_f/S_w)},$$

where LF - light factor;

$S_w$  - area of windows,  $m^2$ ;

$S_f$  - floor area,  $m^2$ .

#### ***Hygienic estimation.***

The light factor must be 1:5 - 1:6 in wards.

#### ***Determination of natural illumination factor.***

Equipment: luxmeter (figure 20).

Work performance:

- a. luxmeter is switched on;
- b. the photo cell is horizontally put on the investigated surface;
- c. the necessary range of measurement beginning from the larger one is established;
- d. the instrument readings are written down;
- e. the special light-absorbing filters are used at high level of illumination, galvanometre indications are multiplied by this factor;
- f. factor of natural illumination is calculated under the formula:

$$\mathbf{FNI = E_i \times 100 / E_o},$$

where FNI - factor of natural illumination, %;

$E_i$  - natural illumination in the given point indoors, lux;

$E_o$  - natural illumination on the horizontal plane in open-air at diffused light, lux.

*Hygienic estimation.*

Factor of natural illumination must be not less than 1 % in wards.



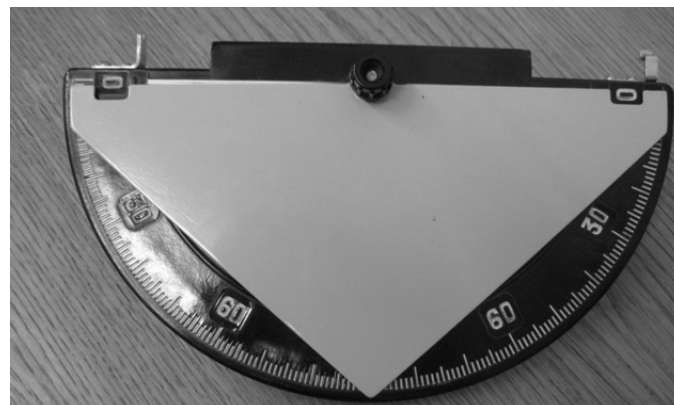
**Figure 20.** Luxmeter.

*Determination of angle of light incidence.*

Equipment: angle meter (figure 21).

Work performance:

- a. angle meter is taken in the left hand;
- b. fixer is weakened so that the index will freely turn on axis;
- c. front sight and pocket mirror with slot are combined and directed at the top edge of window;
- d. the index is pressed by fixer to the basis;
- e. the indication is read on the basis face sheet.



**Figure 21.** Angle meter.

*Hygienic estimation.*

Angle of light incidence must be not less  $27^{\circ}$  in wards.

***Determination of aperture angle.***

Equipment: angle meter.

Work performance:

- a. angle meter is taken in the left hand;
- b. fixer is weakened so that the index will freely turn on axis;
- c. front sight and pocket mirror with slot are combined and directed at the highest point in front of building (tree, other building, etc.);
- d. the index is pressed by fixer to the basis;
- e. the shading corner indication is read on the basis face sheet;
- f. aperture angle is calculated as difference between angle of light incidence and shading corner.

*Hygienic estimation.*

Angle of aperture must be not less  $5^{\circ}$  in wards.

***Determination of horizontal illumination intensity by objective method.***

Equipment: luxmeter.

Work performance:

- a. luxmeter is switched on;
- b. the photo cell is horizontally put on the investigated surface;
- c. the necessary range of measurement beginning from the larger one is established;
- d. the instrument readings are written down;
- e. the special light-absorbing filters are used at high level of illumination, galvanometre indications are multiplied by this factor.

***Determination of horizontal illumination intensity  
by calculation method.***

Equipment: luxmeter, roulette.

Work performance:

- a. general capacity of light sources (N), shined area of floor (S) are found out;
- b. specific capacity (P) is calculated under the formula:



$$P = N/S;$$

c. horizontal illumination is calculated under the formula:

$$E = P \times K,$$

where P - specific capacity of lamps;

K - factor showing the quantity of lux which is given by specific capacity in 1 watt/m<sup>2</sup> (for incandescent lamp with capacity 20-100 watt K is equal 2, for incandescent lamp with capacity 100 watt and more – 2.5, for luminescent lamps - 10).

#### *Hygienic estimation.*

Artificial illumination must be 300 lux in therapist office of polyclinic, 500 lux – in dressing room.

### **Solve a problem, estimate the obtained data and request actions for their improvement**

#### **Situational Task.**

In the ward for children the light factor is 1/8, natural illumination factor is 0.8 %, angle of light incidence is 25°, aperture angle - 3°. Windows are focused on the north. The insolation mode is minimum. Estimate the illumination and offer actions for its improvement.

#### *The algorithm of task's solution:*

The parameters of natural illumination in the ward for children mismatch hygienic requirements: light factor is lowered (normal is 1/5-1/6), natural illumination factor is lowered (normal is 1 %), angle of light incidence is less (normal is not less 27°), aperture angle is less than normal (normal is not less than 5°).

For optimization of the natural illumination parameters it is necessary to arrange the ward for children in other premise with windows orientation to the south or the southeast or to make the artificial illumination corresponding to the specifications.

**1.** In the ward for adults light factor is 1/9, natural illumination factor is 0.6 %, angle of light incidence is 23°, aperture angle - 4°. Estimate the illumination and offer actions for its improvement.

**2.** In the ward for children light factor is 1/6, natural illumination factor is 1 %, angle of light incidence is 25°, aperture angle - 3°. Windows are focused on the north. The insolation mode is minimum. Estimate the

illumination and offer actions for its improvement.

**3.** In the ward for adults light factor is 1/8, natural illumination factor is 0.8 %, angle of light incidence is 25°, aperture angle - 3°. The illumination intensity is 250 lux. Estimate the illumination and offer actions for its improvement.

**4.** In the ward for children light factor is 1/7, natural illumination factor is 1 %, angle of light incidence is 26°, aperture angle - 4°. Windows are focused on the north. The insolation mode is minimum. Estimate the illumination and offer actions for its improvement.

**5.** In the ward for adults light factor is 1/8, natural illumination factor is 0.8 %, angle of light incidence is 25°, aperture angle - 3°. The illumination intensity is 280 lux. Estimate the illumination and offer actions for its improvement.

**6.** In the ward for adults light factor is 1/9, natural illumination factor is 0.6 %, angle of light incidence is 23°, aperture angle - 4°. Estimate the illumination and offer actions for its improvement.

**7.** In the ward for children light factor is 1/6, natural illumination factor is 1 %, angle of light incidence is 25°, aperture angle - 3°. Windows are focused on the north. The insolation mode is minimum. Estimate the illumination and offer actions for its improvement.

**8.** In the ward for adults light factor is 1/8, natural illumination factor is 0.8 %, angle of light incidence is 25°, aperture angle - 3°. The illumination intensity is 250 lux. Estimate the illumination and offer actions for its improvement.

**9.** In the ward for children light factor is 1/7, natural illumination factor is 1 %, angle of light incidence is 26°, aperture angle - 4°. Windows are focused on the north. The insolation mode is minimum. Estimate the illumination and offer actions for its improvement.

**10.** In the ward for adults light factor is 1/8, natural illumination factor is 0.8 %, angle of light incidence is 25°, aperture angle - 3°. The illumination intensity is 280 lux. Estimate the illumination and offer actions for its improvement.

### **The literature.**

1. Lecture № 6.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 109–111, 115.

**Laboratory classes № 23.**

**The topic: HYGIENIC REQUIREMENTS TO MAINTENANCE  
AND DISPOSAL OF HOSPITALS. PREVENTION  
OF HOSPITAL-ACQUIRED INFECTIONS**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for optimization of medical-improving process and personnel working conditions, prevention of hospital-acquired infections.*

**Aim of the Lesson:** to be able to assess hospital's maintenance and clearing and to propose actions for their improvement.

**Checking Questions.**

- ✓ 1. Hygienic requirements to maintenance of hospital's premises.
- ✓ 2. Organization and carrying out of disinfection, disinsection and deratization in hospitals.
- ✓ 3. Hygienic aspects of hospital-acquired infections prevention.
- ✓ 4. Hygienic requirements to disposal of hospitals from solid and liquid wastes.
- ✓ 5. Neutralization of solid and liquid wastes.
- ✓ 6. Methods of studying and estimation of hospital's maintenance and clearing.

**Multiple Choice Questions.**

**Choose proper answers**

1. Current damp cleaning of hospital is carried out:
  - 1) every day;
  - 2) not less than 2 times per day;
  - 3) not less than 3 times per day;
  - 4) not less than 4 times per day;
  - 5) every month.
2. General cleaning of hospital is carried out:
  - 1) every day;
  - 2) once in 3 days;
  - 3) once per week;
  - 4) not less than 4 times per day;
  - 5) every month.

**3. Disinfection is:**

- 1) a set of actions directed on destruction of pathogenic and opportunistic pathogenic microorganisms being in environment;
- 2) a set of actions directed on destruction of arthropodscarriers of activators of infectious and invasion diseases;
- 3) a set of actions directed on destruction of rodents being an activators of infectious and invasion diseases;
- 4) a set of actions directed on destruction of all the microorganisms in the environment;
- 5) a set of actions directed on destruction of disinfectants.

**4. Deratization is:**

- 1) a set of actions directed on destruction of pathogenic and opportunistic pathogenic microorganisms being in environment;
- 2) a set of actions directed on destruction of arthropodscarriers of activators of infectious and invasion diseases;
- 3) a set of actions directed on destruction of rodents being an activators of infectious and invasion diseases;
- 4) a set of actions directed on destruction of all the microorganisms in the environment;
- 5) a set of actions directed on destruction of disinfectants.

**5. Disinsection is:**

- 1) a set of actions directed on destruction of pathogenic and opportunistic pathogenic microorganisms being in environment;
- 2) a set of actions directed on destruction of arthropods carriers of activators of infectious and invasion diseases;
- 3) a set of actions directed on destruction of rodents being an activators of infectious and invasion diseases;
- 4) a set of actions directed on destruction of all the microorganisms in the environment;
- 5) a set of actions directed on destruction of poisonings.

**6. Methods of disinfection are:**

- 1) physical;
- 2) mechanical;
- 3) chemical;
- 4) manual;
- 5) biological.

**7. Features of the physical method of disinfection are:**

- 1) reliable;

- 2) ecologically pure;
  - 3) skin irritating action;
  - 4) safe for personnel;
  - 5) low antimicrobial activity.
- 8. Chemical disinfection is spent using:**
- 1) immersing in a solution;
  - 2) irrigation;
  - 3) wiping;
  - 4) ultraviolet and ultrasonic irradiation;
  - 5) influences of heat, pair, hot air and water.
- 9. Requirements to chemical disinfectants are:**
- 1) wide spectrum of antimicrobial action;
  - 2) small toxicity (III or IV class);
  - 3) long terms of use of working solution;
  - 4) slow formation of resistant variants of microorganisms;
  - 5) low aggression in relation to materials.
- 10. Methods of disinfection are:**
- 1) physical;
  - 2) mechanical;
  - 3) chemical;
  - 4) manual;
  - 5) biological.
- 11. Methods of deratization are:**
- 1) physical;
  - 2) mechanical;
  - 3) chemical;
  - 4) manual;
  - 5) biological.
- 12. Systems of disposal of hospital from solid wastes are:**
- 1) export system;
  - 2) floatable (sewer) system;
  - 3) plan-household system;
  - 4) plan-flat system;
  - 5) local system.
- 13. Hospital-acquired infections are:**
- 1) infectious diseases that can be treated in hospitals;
  - 2) widespread noninfectious diseases;

- 3) various infectious diseases got by patients during their examination or treatment in polyclinics and hospitals;
  - 4) incurable infectious diseases;
  - 5) various infectious diseases got by patients during being abroad.
- 14.** Sources of hospital-acquired infections are:
- 1) healthy visitors;
  - 2) infectious patients who have arrived in a hospital with mixed infection;
  - 3) all the personnel;
  - 4) somatic patients who have arrived in a hospital in incubatory period;
  - 5) carriers of pathogenic staphylococci, streptococci and other pathogenic microbes.
- 15.** Prevention of hospital-acquired infections is spent on:
- 1) nonspecific actions;
  - 2) specific actions;
  - 3) legislative, planning, technological, sanitary-technical, organizational actions;
  - 4) disinfection-sterilising actions;
  - 5) passive and active immunization.

### **Laboratory Work.**

- 1. Determine disinfection quality of premises, sterilizations of material and bacterial impurity of personnel's hands.
- 2. Estimate the received results.
- 3. Offer actions for improvement of hospital's work regimen.
- 4. Record the laboratory work report.

#### ***Determination of chemical disinfection quality of premises.***

Equipment and reagents: cotton wool, Petri dish, 10 % solution of potassium iodide, 1 % starch solution, solution of lime chloride.

Work performance:

- a. cotton wool is moistened with 10 % solution of potassium iodide;
- b. cotton wool is moistened with 1 % solution of starch and touched to the controllable surface;
- c. determination of chemical disinfection quality is spent not earlier than through 45 min and not later than through 2 h after disinfection.

*Hygienic estimation.*

Chemical disinfection is considered as qualitative at occurrence of dark blue colour on the cotton wool that testifies about the presence of active chlorine.

***Determination of physical disinfection quality of premises.***

Equipment: microcalculator, roulette, bactericidal lamps (figure 22).

Work performance:

- a. width, length and height of premise are measured;
- b. premise volume is calculated;
- c. capacity and quantity of bactericidal lamps are counted;
- d. specific capacity of bactericidal lamps is calculated under the formula:

$$A = (a \times n) / V,$$

where A - specific capacity, watt/m<sup>3</sup>;

a - capacity of bactericidal lamp, watt;

n - quantity of bactericidal lamps;

V - premise volume, m<sup>3</sup>.



**Figure 22.** Bactericidal lamp.

*Hygienic estimation.*

Physical disinfection is considered as qualitative at specific capacity of open bactericidal lamps 2-2.5 watt/m<sup>3</sup>, closed - 1 watt/m<sup>3</sup>.

***Determination of efficiency of material sterilization.***

Equipment and reactants: autoclave (figure 23), tubes for chemical substances, benzoic acid, thiourea, fuchsine.

Work performance:

- a. benzoic acid (at definition of the efficiency of 120<sup>0</sup>C sterilization) or thiourea (at definition of the efficiency of 180<sup>0</sup>C sterilization) is placed in tube, a few fuchsine is added, the tube is closed;
- b. the tube is placed into autoclave between sterilized subjects;
- c. the colour of indicator is noted at the end of sterilization.



**Figure 23.** Autoclave.

*Hygienic estimation.*

Indicator colour must be crimson at correct regimen of sterilization.

***Determination of efficiency of material sterilization  
by thermotime indicator.***

Equipment and reactants: dry-heat case (figure 24), TVI IS-120, TVI IS-180.

Work performance:



- a. TVI IS-120 (at definition of the efficiency of 120<sup>0</sup>C sterilization) or TVI IS-180 (at definition of the efficiency of 180<sup>0</sup>C sterilization) is placed in to dry-heat case between sterilized subjects;
- b. the colour of indicator is noted at the end of sterilization.

*Hygienic estimation.*

Indicator colour must be brown at correct regimen of sterilization.



**Figure 24.** Dry-heat case.

***Determination of efficiency of personnel's hands processing.***

Equipment and reactants: thermostat (figure 25), measured pipettes, sterile test tubes with sterile wadded tampons, Petri dish, peptonic agar.

Work performance:

- a. palms, interdigital and hyponychial spaces of fingers are wiped with the damp sterile tampon;
- b. the tampon is placed in the test tube;
- c. 8 sm<sup>3</sup> of sterile water is added and carefully washed during 2-3 min;
- d. five consecutive tenfold cultivations is prepared and brought on 1 sm<sup>3</sup> in sterile Petri dish;
- e. it is filled with peptonic agar and placed in thermostat at 37<sup>0</sup>C for 48 h;
- f. calculation of evolved colonies is spent by means of counter.



**Figure 25.** Thermostat.

*Hygienic estimation.*

Presence of *E.coli* in washouts testifies about non-observance by the personnel of personal hygiene rules.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

In the air of the surgery block before work 600 CFU/m<sup>3</sup> and after work 1100 CFU/m<sup>3</sup>, 5 aurococci /250 dm<sup>3</sup>, 1 mold fungus and 1 yeast fungus/250 dm<sup>3</sup> are revealed. Estimate the air condition and offer actions for its improvement.

*The algorithm of task's solution:*

The air of the surgery block mismatches hygienic requirements: the total bacterial count before work and after work is raised (normal are 500 and 1000 CFU/m<sup>3</sup> respectively), the quantity of aurococci, mold and yeast are raised (they should not be at all).

It is necessary to process the surfaces better, i.e. current and general cleaning. The air should be disinfected by bactericidal lamps, and it should be replaced when it needs. Also it is necessary to make the periodic control of processing.

**1.** In the air of the surgery block before work 1000 CFU/m<sup>3</sup> and after work 1900 CFU/m<sup>3</sup>, 1 aurococcus/250 dm<sup>3</sup>, 2 mold fungus and 2 yeast fungus /250 dm<sup>3</sup> are revealed. Estimate the air condition and offer actions

for its improvement.

**2.** In the air of the postoperative room the total bacterial count is 890 CFU/m<sup>3</sup>. Estimate the air condition and offer actions for its improvement.

**3.** In the aseptic room air passed for the analysis before work with speed of 25 dm<sup>3</sup>/min within 2 minutes. On the Petri dish 30 colonies of microorganisms have grown. Estimate the air condition and offer actions for its improvement.

**4.** In the air of the postoperative room the total bacterial count is 920 CFU/m<sup>3</sup>. Estimate the air condition and offer actions for its improvement.

**5.** In the aseptic room air passed for the analysis before work with speed of 25 dm<sup>3</sup>/min within 2 minutes. On the Petri dish 35 colonies of microorganisms have grown. Estimate the air condition and offer actions for its improvement.

**6.** In the air of the surgery block before work 1100 CFU/m<sup>3</sup> and after work 2000 CFU/m<sup>3</sup>, 2 aurococcus /250 dm<sup>3</sup>, 1 mold fungus and 2 yeast fungus/250 dm<sup>3</sup> are revealed. Estimate the air condition and offer actions for its improvement.

**7.** In the air of the postoperative room the total bacterial count is 950 CFU/m<sup>3</sup>. Estimate the air condition and offer actions for its improvement.

**8.** In the aseptic room air passed for the analysis before work with speed of 25 dm<sup>3</sup>/min within 2 minutes. On the Petri dish 40 colonies of microorganisms have grown. Estimate the air condition and offer actions for its improvement.

**9.** In the air of the surgery block before work 900 CFU/m<sup>3</sup> and after work 1200 CFU/m<sup>3</sup>, 4 aurococcus /250 dm<sup>3</sup>, 2 mold fungus and 1 yeast fungus/250 dm<sup>3</sup> are revealed. Estimate the air condition and offer actions for its improvement.

**10.** In the air of the surgery block before work 1000 CFU/m<sup>3</sup> and after work 1900 CFU/m<sup>3</sup>, 1 aurococcus /250 dm<sup>3</sup>, 2 mold fungus and 2 yeast fungus/250 dm<sup>3</sup> are revealed. Estimate the air condition and offer actions for its improvement.

### **The literature.**

1. Lecture № 6, 7.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 115-124.

**Laboratory classes № 24.****The topic: HYGIENIC REQUIREMENTS TO PLANNING, SANITARY-TECHNICAL ACCOMPLISHMENT AND MAINTENANCE OF OUT-PATIENT-POLYCLINIC ORGANIZATIONS**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for optimization of medical-improving process and personnel working conditions.*

**Aim of the Lesson:** to be able to assess lay out and placing of out-patient-polyclinic organizations and to propose actions for their improvement.

**Checking Questions.**

- ✓ 1. Out-patient-polyclinic organizations, their role in rendering of medical aid to the population. Functional duties of district physician.
- ✓ 2. Hygienic requirements to choice and planning of ground area of a polyclinic.
- ✓ 3. Hygienic requirements to internal lay out of polyclinics.
- ✓ 4. Hygienic requirements to sanitary-technical accomplishment and microclimate of polyclinics.
- ✓ 5. Hygienic requirements to furnish, equipment and maintenance of polyclinics.
- ✓ 6. Methods of studying and estimation of planning, sanitary-technical accomplishment, microclimate, equipment and maintenance of out-patient-polyclinic organizations.

**Multiple Choice Questions.****Choose proper answers**

1. Out-patient-polyclinic organizations are:
  - 1) female consultations;
  - 2) advisory diagnostic centres;
  - 3) children's polyclinics;
  - 4) medical-sanitary units;
  - 5) polyclinics.
2. Functions of polyclinics are:
  - 1) rendering of first medical aid at acute and sudden diseases, traumas;
  - 2) examination of time invalidity;
  - 3) direction of patients on sanatorium treatment;

- 4) treatment of patients at reference in polyclinic and in-home;
  - 5) organization and carrying out of prophylactic medical examination of population.
- 3.** Functional duties of district physicians includes performance of:
- 1) social work;
  - 2) valeological work;
  - 3) antiepidemic work;
  - 4) hygienic work;
  - 5) preventive work.
- 4.** Hygienic section of physicians' work consists in studying of:
- 1) atmospheric air, water, soil;
  - 2) population's life;
  - 3) work influence on population's health;
  - 4) conditions of residing;
  - 5) population's food.
- 5.** Preventive work of physicians includes:
- 1) carrying out of vaccination;
  - 2) carrying out of medical inspections of population;
  - 3) dispensary supervision over healthy and sick patients;
  - 4) treatment of patients;
  - 5) presence of invalidity.
- 6.** Territory zones of polyclinic ground area are:
- 1) rest;
  - 2) auxiliary;
  - 3) polyclinic;
  - 4) basic;
  - 5) economic.
- 7.** Requirements to the polyclinic site:
- 1) area of green plantings should be 60 % or more;
  - 2) distains between economic constructions and garbage container should be not less than on 30 m;
  - 3) building area should be 15 % or less of total area;
  - 4) green plantings strip should be 15 m width into the perimeter of a polyclinic area;
  - 5) platform for visitors should be 0.02 m<sup>2</sup> on one visiting in a shift.
- 8.** Polyclinic units are:
- 1) administrative part;
  - 2) general premises;

- 3) reception;
  - 4) ward unit;
  - 5) treatment-prophylactic unit.
- 9.** Treatment-prophylactic unit of polyclinic is:
- 1) department of emergency help;
  - 2) therapeutic department;
  - 3) preventive department;
  - 4) medical-diagnostic department;
  - 5) auxiliary department.
- 10.** Structure of preventive department of polyclinic is:
- 1) office of sanitary education and hygienic education of population;
  - 2) offices of functional diagnostics;
  - 3) office of propagation of healthy lifestyle;
  - 4) office of premedical reception;
  - 5) anamnestic room.
- 11.** Structure of medical-diagnostic department of polyclinic is:
- 1) X-ray office;
  - 2) physio-therapy department;
  - 3) surgery department;
  - 4) clinical-diagnostic laboratory;
  - 5) offices of functional diagnostics.
- 12.** The proper microclimate regimen in polyclinic:
- 1) relative humidity is 55-60 %;
  - 2) relative humidity is 60-65 %;
  - 3) relative humidity is 65-70 %;
  - 4) speed of air motion is not above 0.15 m/s;
  - 5) speed of air motion is not above 0.3 m/s.
- 13.** The water arriving to polyclinic should be:
- 1) colourless;
  - 2) with natural chemical compound;
  - 3) transparent;
  - 4) free of toxic chemical and radioactive substances, pathogenic micro-organisms, cysts of Protozoa and helminthes eggs;
  - 5) free of smell.
- 14.** In physician's office should be:
- 1) angle of light incidence not less  $37^{\circ}$ ;
  - 2) natural illumination factor 1.8 %;
  - 3) angle of light incidence not less  $27^{\circ}$ ;
  - 4) aperture angle not less  $5^{\circ}$ ;

5) light factor 1/5-1/6.

**15.** General cleaning of polyclinic's premises is carried out:

- 1) every day;
- 2) once in 3 days;
- 3) once per week;
- 4) not less than 4 times per day;
- 5) every month.

### **Laboratory Work.**

- 1. Lead examination of the polyclinic's project (explanatory note, situational and general plans, working drawings).
- 2. Estimate the received results.
- 3. Offer actions for rationalization of the polyclinic project.
- 4. Record the laboratory work report.

### ***Hygienic examination of the polyclinic's project.***

Equipment: rulers, pencils, project with explanatory note, situational plan, general plan, working drawings of polyclinic.

Work performance:

1) address of establishment, its capacity are found out from the explanatory note.

2) the following data is found out from the situational plan of polyclinic:

- sufficiency of breaks between polyclinic and nearest sources of pollution of atmospheric air, ground, water;
- location on winds rose;
- presence of road network;
- area incline.

3) the following data is found out from the general plan of polyclinic:

- size of site and areas;
- zones of site;
- percent of building and gardening;
- sites of building;
- economic constructions;
- watersource, sanitary-technical objects;
- orientation of buildings.

4) internal planning of the polyclinic, set of rooms, its interrelation and areas are found out from the working drawings of the polyclinic.

*Hygienic estimation.*

The received results are compared with SNaR 2.08.02-89 «Public buildings and constructions. Norms of designing».

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

In the treatment room of the surgical department of city's polyclinic saprophytes contents in air before work 1500 CFU/m<sup>3</sup>, *E.coli* on the nurse's hands are revealed. Estimate the received results and offer improving actions.

*The algorithm of task's solution:*

Microbial contamination in the treatment room does not correspond to the hygienic requirements: total microbial contamination of air is increased (normal is 500 CFU/m<sup>3</sup>), *E.coli* colonies normally must not be detected on hands of staff. Thus in the treatment room poorly conducted current damp cleaning and poorly processed nurse's hands are marked .

It is necessary to carry out the current damp cleaning with usage of bactericidal lamps in the final stage and produce hand processing of nurses.

**1.** On the general plan the polyclinic zone and rest zone, platform for visitors with 30 m<sup>2</sup> per 1 person are provided. Green area is 40% of the land area. There are 2 entrances: main and auxiliary. Estimate the received results and offer improving actions.

**2.** On the general plan of the urban polyclinic the polyclinic and economic zones are allocated. Building of polyclinic is located on distance 5 m from red line. Platform for visitors is not provided. Green area is 35 % of the total area. Economic constructions and waste container are located on the separate platform far from main building on distance 8 m. Estimate the received results and offer improving actions.

**3.** The preventive department of the polyclinic is located on the 2nd floor of the therapeutic department. In the preventive department the office of organization and control of clinical examination of population, the room of healthy lifestyles and the central registration of annual medical examina-



tion are organized. Estimate the received results and offer improving actions.

**4.** The treatment-preventive division consists of the preventive department and treatment-diagnostic departments. The treatment-diagnostic unit consists of doctors rooms, X-ray rooms and clinical diagnostic laboratory. Estimate the received results and offer improving actions.

**5.** In the dressing cabinet of the surgical room air temperature is 26°C, relative humidity is 40%, ventilation rate of air is +1-1. Estimate the received results and offer improving actions.

**6.** In office of district physician air temperature is 18°C, air speed is 0.3 m/s. Artificial ventilation provides a one-time air. Air flow is from the corridor. Estimate the received results and offer improving actions.

**7.** In the physiotherapy room of polyclinic light factor is 1/4, FNI is 0.3 %, angle of light incidence is 26°, aperture angle is 4°, artificial illumination is 200 lx. Estimate the received results and offer improving actions.

**8.** Water of the city polyclinic has 4 points on taste and smell, 40° of color, 5 mg/dm<sup>3</sup> of turbidity, 400 mg/dm<sup>3</sup> of chlorides, 600 mg/dm<sup>3</sup> of sulfates. Estimate received results and offer improving actions.

**9.** In the surgical department of the polyclinic damp cleaning is carried out 1 time per day, general cleaning - 1 time per month. Special sanitary wear and home wear of medical staff are kept in individual locker. Medical clothing is replaced weekly. Estimate the received results and offer improving actions.

**10.** In the dressing room of the polyclinic after general cleaning and irradiation by the closed bactericidal lamp with capacity 0.5 Wt/m<sup>3</sup> total bacterial dissemination of air is 2500 CFU/m<sup>3</sup>, number of staphylococci – 5 in 250 m<sup>3</sup> of air. Estimate the received results and offer improving actions.

### **The literature.**

1. Lectures № 6, 7.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 97–124.

**Laboratory classes № 25.****The topic: HYGIENIC CHARACTERISTIC OF WORKING CONDITIONS OF MEDICAL WORKERS**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for optimization of medical-improving process and personnel working conditions.*

**Aim of the Lesson:** to be able to assess working conditions of doctors and to propose actions for their improvement.

**Checking Questions.**

- ✓ 1. Hygienic requirements to working conditions of medical personnel.
- ✓ 2. Features of doctors' work.
- ✓ 3. Hygiene of work of surgeons, obstetricians-gynecologists, anaesthesiologists, intensive care doctors.
- ✓ 4. Hygiene of work of physicians, psychiatrists, infectious doctors.
- ✓ 5. Hygiene of work of roentgenologists and radiologists.
- ✓ 6. Prevention and investigation of professional pathology of medical workers.

**Multiple Choice Questions.****Choose proper answers**

1. Working conditions of medical personnel are:
  - 1) harmful;
  - 2) excellent;
  - 3) dangerous;
  - 4) optimum;
  - 5) admissible.
2. Features of doctors work are:
  - 1) infringement of work regimen;
  - 2) high congestion of working day;
  - 3) metabolism infringement;
  - 4) presence of fixed lunch break;
  - 5) presence of diurnal and night watches.
3. Doctors' harmful factors are:
  - 1) raised and depressed atmospheric pressure;

- 2) ionizing, laser and ultraviolet radiations;
  - 3) physical dynamic loading;
  - 4) high nervous and emotional stress;
  - 5) influence of aerosols of antibiotics.
- 4. Physicians' adverse professional factors are:**
- 1) work disturbance;
  - 2) X-ray irradiating;
  - 3) unfavorable environmental factors;
  - 4) possibility of infestation by infectious diseases from contact to patient;
  - 5) night watches.
- 5. Doctors anesthesiologists' adverse professional factors are:**
- 1) irrational regimen of work;
  - 2) heating microclimate;
  - 3) high nervous and emotional stress;
  - 4) influence of antibiotics;
  - 5) X-ray irradiating.
- 6. Psychiatrists' adverse professional factors are:**
- 1) presence of diurnal and night watches;
  - 2) influence of electric current;
  - 3) influence of ozone;
  - 4) influence of magnetic field;
  - 5) influence of ultrasonic sound.
- 7. Doctors surgeons' adverse professional factors are:**
- 1) night watches;
  - 2) influence of magnetic field;
  - 3) microbial factor;
  - 4) heating microclimate;
  - 5) high nervous and emotional stress.
- 8. Radiologists' adverse professional factors are:**
- 1) unfavorable microclimate;
  - 2) insufficient light exposure;
  - 3) night watches;
  - 4) raised radioactivity;
  - 5) ozone and nitrogen oxides influence.
- 9. Production factors of doctors are:**
- 1) difficult;
  - 2) psycho-physiological;
  - 3) biological;
  - 4) mechanical;

5) chemical.

**10.** Doctors' working conditions are:

- 1) chemical, physical and biological factors of environment;
- 2) character and work organization;
- 3) planning and sanitary-technical accomplishment of premises;
- 4) household maintenance of workers;
- 5) psychological climate in collective.

**11.** For investigation of doctors' professional pathology it is necessary to know:

- 1) the date and hour of an incident;
- 2) the disease was revealed during routine physical examination/during visit to a doctor;
- 3) the experience of work in the conditions of the harmful production factors influence which have caused the disease;
- 4) the victim's state of health at the moment of investigation;
- 5) the immediate cause of the occupational disease.

**12.** Prevention of doctors' professional pathology is spent on:

- 1) legislative actions;
- 2) technological actions;
- 3) sanitary-technical actions;
- 4) planning actions;
- 5) organizational actions.

**13.** Doctors' personal protective equipments are:

- 1) oilcloth apron;
- 2) rubber gloves;
- 3) masks;
- 4) shoe covers;
- 5) oversleeves.

**14.** Treatment-preventive actions are:

- 1) sanatorium treatment;
- 2) medical inspections;
- 3) rational illumination;
- 4) work and rest rationalization;
- 5) vitaminization.

**15.** Medical personnel of hospitals is provided with:

- 1) dressing gowns;
- 2) hats or kerchiefs;
- 3) jackets;

- 4) trousers;
- 5) footwear.

### **Laboratory Work.**

- 1. Study working conditions of a doctor, personal dose of irradiation, surface level of pollution.
- 2. Estimate the received results.
- 3. Offer actions for improvement of working conditions of a doctor.
- 4. Record the laboratory work report.

#### *The scheme of sanitary-hygienic studying of a detailed trade.*

- Trade;
- arrangement of workplaces;
- application of special methods of mechanization and automation;
- characteristic and timing of technological operations;
- physiological features at performance of operations (quantity of working-class movements in minutes, monotony of working-class movements);
- working pose, compelled position of a body, strain of separate bodies;
- level of gravity of physical work (weight of lifted load, weight of transferable load during shift) and intellectual tension;
- characteristic of sanitary-engineering accomplishment (illumination, heating, ventilation, water supply, clearing);
- characteristic of working conditions (microclimate, content of chemical substances in air, physical and biological factors);
- conclusion;
- offers on improvement of working conditions, date of the inspection, name of the inspectioner.

#### *Hygienic estimation.*

The received results are compared with indicators of SanRandN for treatment-prophylactic organizations.

#### *Determination of personal dose of irradiation.*

Equipments: Personal dosimeters ИД-1 (picture 26).

Work performance:

- a. charged and established on «0» position dosimeter is put in a breast pouch of clothes;
- b. periodically observing in the dosimeter ocular the size of personal dose of irradiation gained in the operation time is marked.



**Picture 26.** Personal dosimeters.

*Hygienic estimation.*

Admissible capacity of the dose on the workplace of roentgenologist is no more than 7 mR/h at work 15 h in a week.

*Determination of surface level of pollution.*

Equipments: dosimeter-radiometer АНРИ-01 «Сочна» (picture 27).

Work performance:

- a. the duty switch is put in position МД;
- b. button "is included" is put in the left position;
- c. the device is brought to the investigated surface with plane of the back cover on distance 0.5-1 cm and button «start-up» is quickly pressed;
- d. the instrument readings ( $N_{\gamma}$ ) are measured and written down;
- e. the following measurement is spent similarly only with the opened back cover;
- f. the instrument readings ( $N_{\gamma+\beta}$ ) are measured and written down.

Magnitude of density of the beta-particles stream from the surface is calculated under the formula:

$$q = Ks \times (N_{\gamma+\beta} - N_{\gamma});$$

where  $N_{\gamma}$  - the instrument reading with the closed back cover without a comma on the board;

$N_{\gamma+\square}$  - the instrument reading with the opened back cover without a comma on the board;

$K_s$  - the factor of the account of the device is  $0.5 \text{ particles/cm}^2\text{min} \times \text{impulse}$ .



**Picture 27.** Dosimeter-radiometer АНРИ-01 «Сосна».

*Hygienic estimation.*

The contamination tolerance level of  $\beta$  - active radioactive nuclides of a surface in premises is  $2000 \text{ particles/cm}^2\text{min}$ .

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

The nurse who is constantly working with antibiotics passes the periodic medical examination 1 time every 2 years with the participation of therapist, obstetrician-gynecologist. She performs the urinalysis. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

*The algorithm of task's solution:*

The medical examination of the nurse is organized in violation of Regulation of Ministry of Health of the Republic of Belarus "On the procedure of compulsory medical examinations of workers» № 33 dated by

08.08.2000. The multiplicity of medical examination has been broken (the required multiplicity is 1 time every year). Dermatologist and otolaryngologist have not been involved, the study of blood leukocyte counts has not been held.

It is necessary to increase the multiplicity of passing of the medical examination with the involving of the required doctors into the commission and to perform the laboratory tests in full.

1. The doctor-laboratorian investigating the infected material is undergone to the periodic medical examination 1 time per quarter with the involvement of therapist, infectionist, gynecologist. He performs the research on blood leukocyte formula. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

2. The dentist constantly working with arsenic is undergone to the periodic medical examination 1 time every year with the involvement of therapist and otolaryngologist. He performs the general analysis of blood and urine. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

3. The radiologist is undergone to the periodic medical examination 1 time every 3 years with the involvement of therapist, infectionist, obstetrician-gynecologist. He performs the blood leukocyte formula. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

4. The nurse constantly working in the tuberculosis dispensary is undergone to the periodic medical examination 1 time per year with the involvement of therapist, obstetrician-gynecologist, infectionist, ophthalmologist. She performs the general analysis of urine, blood, ultrasound of the abdomen. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

5. The laboratory technician working with formaldehyde is undergone to the periodic medical examination 1 time every 6 months with the involvement of therapist, surgeon, obstetrician. He researches urine and blood leukocyte formulas. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

6. The nurse constantly working in the tuberculosis dispensary is undergone to the periodic medical examination 2 time per year with the involvement of obstetrician-gynecologist, infectionist, ophthalmologist. She



performs the general analysis of urine and blood. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

7. The anesthesiologist working with narcotic substances is undergone to the periodic medical examination 1 time every year with the involvement of therapist, surgeon, obstetrician. He researches urine and blood leukocyte formulas. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

8. The surgeon is undergone to the periodic medical examination 1 time every 3 years with the involvement of therapist, infectionist, obstetrician-gynecologist. He performs the blood leukocyte formula. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

9. The radiologist is undergone to the periodic medical examination 1 time every 5 years with the involvement of therapist and infectionist. He performs the blood leukocyte formula. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

10. The nurse constantly working in the physiotherapy room is undergone to the periodic medical examination 1 time per year with the involvement of therapist, obstetrician-gynecologist, infectionist, ophthalmologist. She performs the general analysis of urine, blood, ultrasound of the abdomen. Estimate the regularity of organization and carrying out of the medical examination and offer optimization actions.

#### **The literature.**

1. Lecture № 7.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 75, 89, 94-96.

**Laboratory classes № 26.****The topic: SANITARY-EPIDEMIOLOGICAL SUPERVISION  
OF HOSPITALS AND OUT-PATIENT-POLYCLINIC  
ORGANIZATIONS (PRACTICAL WORK)**

*The theme has great value for the further training at clinical departments, in practical work of a doctor for optimization of medical-improving process and personnel working conditions.*

**Aim of the Lesson:** to be able to make sanitary inspection of public health care organizations.

**Checking Questions.**

- ✓ 1. State sanitary inspection of hospitals and out-patient-polyclinic organizations.
- ✓ 2. Structure of sanitary-epidemiologic service.
- ✓ 3. Center of hygiene and epidemiology, its structure and functions.
- ✓ 4. Epidemiology department of hygiene and epidemiology centre, its structure, functions. Functional group for supervision of hospitals.
- ✓ 5. Hygiene department of hygiene and epidemiology center, its structure, functions.
- ✓ 6. Methods of studying and estimation of sanitary-hygienic condition of hospitals and out-patient-polyclinic organizations.

**Practical Work.**

- 1. Organize current sanitary inspection of hospitals.
- 2. Develop the scheme of hygienic inspection of hospital.
- 3. Record the laboratory work report.

***Organization of current sanitary inspection of hospitals.*****MINISTRY OF HEALTH SERVICE  
OF THE REPUBLIC OF BELARUS**

«Vitebsk regional center of hygiene, epidemiology  
and public health»

(The establishment providing the state sanitary inspection)

THE ORDER № ...for planned control

On the basis of the Law of the Republic of Belarus, November, 23rd,

1993 «About sanitary-epidemic well-being of population» in edition of the Law of the Republic of Belarus, May, 23rd, 2000 and the Decree of the President of the Republic of Belarus, October, 16th, 2009 №510 «About perfection of control (supervising) activity in the Republic of Belarus»

In the period from «..» ... 201.. to «..» ... 201.. it will be spent the planned control of Second Vitebsk regional clinical hospital, Nekrasova street, 10.

The legislation bases of carrying out of the control: SanNandR «Hygienic requirements to hospital's planning, sanitary-technical accomplishment, keeping».

(Point of the coordination plan)

The control period: ... year.

Control is spent by: doctor-epidemiologist of epidemiology unit, doctor-hygienist of municipal hygiene department, doctor-hygienist of nutrition hygiene department, doctor-hygienist of work hygiene department, laboratorian of sanitary-chemical and toxicological laboratory, laboratorian of physical factors laboratory, laboratorian of microbiological laboratory.

The list of questions which are subject to control: hospital's lay out, sanitary-technical accomplishment, microclimate, keeping, working conditions of doctors, personal hygiene of doctors.

The main state health officer signature.

### **The literature.**

1. Lecture № 1.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 14-16.

**Laboratory classes № 27.****The topic: SANITARY-HYGIENIC ESTIMATION OF HOSPITAL'S LAY OUT, SANITARY-TECHNICAL ACCOMPLISHMENT AND MAINTENANCE (PRACTICAL WORK)**

*The theme has great value for the further training at department of public health and public health services, departments of therapeutic and surgical profile, in practical work of a doctor for creation of optimum medical-improving regimen and personnel working conditions, prevention of hospital-acquired infections.*

**Aim of the Lesson:** to be able to make sanitary-hygienic inspection of hospital's lay out, sanitary-technical accomplishment and maintenance and to propose actions for its improvement.

**Checking Questions.**

- ✓ 1. Hygienic requirements to hospital ground area.
- ✓ 2. Hygienic requirements to internal lay out of hospital.
- ✓ 3. Hygienic requirements to furnish, equipment of premises of hospitals. Polymeric building materials.
- ✓ 4. Hygienic requirements to sanitary-technical accomplishment and microclimate of hospitals.
- ✓ 5. Hygienic requirements to maintenance of hospitals.
- ✓ 6. Methods of studying and estimation of hospital's lay out, sanitary-technical accomplishment and maintenance.

**Practical Work.**

- 1. Make sanitary-hygienic inspection of hospital.
- 2. Estimate the received results.
- 3. Offer actions for improvement of hospital's lay-out, sanitary-technical accomplishment and maintenance.
- 4. Record the act of hospital inspection.

***Scheme of sanitary-hygienic inspection of hospital.***

1. The hospital name and address.
2. Year of building, quantity of served population.
3. General number of beds: regular, actual distribution of beds in departments.
4. Hospital location.

5. Environment: residential district, green zone, industrial enterprises, streets polluting air and making noise, wind rose.
6. Area characteristics: raised, low, soil sandy, clay, crude, dry, boggy, pure, polluted.
7. Hospital ground area: area, % of building, % of green plantings, width of green zone on site perimeter, distance between medical buildings and economic zone, maintenance of territory, number of entrances, use of hospital garden for patients walks.
8. Zoning of hospital territory.
9. System of hospital's building, number of medical buildings, floors, distance between medical and economic buildings, pathoanatomical department, economic zone. Sanitary condition, ground area cleaning.
10. Internal planning of hospital.
11. Reception (accident ward): lay out, reception of order of patients.
12. Bedside department: lay out, ward sections, height, width, depth of wards, quantity of single, two-place, four-seater wards.
13. Number of wards in department, average area and cubic capacity for 1 bed.
14. Furnishing of wards, alarm system, installation of wired radio units.
15. Corridors: lateral, central, light breaks at central corridors, width of corridor, use.
16. Dressing and room for medical procedures: placing, area.
17. Room of day stay of patients and reception of visitors.
18. Dining room.
19. Still-room, its sizes, equipment, sanitary condition, who distributes food.
20. Linen room, regimen of linen change, quality of linen, condition.
21. Lavatory: placing, isolation from wards, planning, sanitary condition.
22. Premises for duty personnel.
23. Medical-diagnostic division of hospital. Pathoanatomical unit. Polyclinic unit. Nutrition unit, disinfecting unit, central sterilization department.
24. Surgery block: isolation from wards, lay out, sanitary-technical accomplishment, sanitary condition.
25. Water supply, canalization, presence and system of sewage disposal.
26. Heating: central, local, type and placing of heating devices in buildings, serviceability, sufficiency, air temperature in basic premises, uniformity within days.

27. Ventilation: general, local, natural, artificial, serviceability, ventilation rate in basic premises, presence of window leaves, transoms, airing regimen.
28. Illumination: orientation, arrangement and maintenance of windows, blackout by the nearby buildings, light factor and factor of natural illumination in basic premises, artificial illumination, type of lamps, sufficiency, placing of lamps.
29. Walls of medical buildings: material, internal furnish, condition, presence of dampness, materials and condition of floors.
30. System of cleaning of hospital's premises.
31. Morbidity of medical and support personnel.
32. Additional data.
33. General conclusion about lay out, accomplishment and sanitary condition of the object.
34. Improvement offers.
35. Inspection date. The signature.

**PUBLIC HEALTH CERTIFICATE  
of Second Vitebsk regional clinical hospital**

I am, the student of the 3<sup>rd</sup> year of medical faculty of Vitebsk State Medical University, */Full name/*, group №\_\_, have made the sanitary inspection of lay-out, sanitary-engineering accomplishment and maintenance of Second Vitebsk regional clinical hospital.

It is established:

1. Second Vitebsk regional clinical hospital is located on Nekrasov's street, 10, in Vitebsk.

Its medical activity is carried out according to licence №02040/0312085 registered in the register № M-3421 within 03.01.2010 y., pharmaceutical activity - licence №02040/0423067, registered in the register № F-853 within 26.03.2014 y., the activity connected with turnover of narcotics, psychotropic drugs and its precursors - licence № 02040/0423068 H-755 within 26. 03.2014 y.

2. The main building and the pathology department of the hospital were built in 1959, the surgical block is completed in 1971, quantity of the served population - 15000 people.

3. The hospital is meant for 260 beds, including 49 beds in the surgical unit, 39 beds in the proctological unit, 39 beds in the gynecologic, 59

beds in the cardiological, 39 beds in the gastroenterologic, 29 beds in the neurologic, 6 beds in the resuscitation unit.

Average number of workers is 290, including 29 doctors and 112 nurses.

4. The hospital is located in 900-1000 m from railway station and in 300 m from railway lines.

5. Eastwards of the hospital the residential block is located, southwards - railway lines, westwards - private residential sector, northwards - Nekrasov's street with non intensive auto traffic. The domination wind direction according to wind rose is western.

6. The hospital is located on raised land, site soil is loamy, dry, and pure.

7. The hospital ground area is walled with the ferroconcrete fence, there is no gardening into the perimeter. The area of the site is 2.97 hectares (186 m x 164 m), the building area is 0,6 hectares, area of green plantings is 1.2 hectares. Between the main building and the economic zone there is the hospital garden consisting mainly from fruit-trees. The territory is well arranged, lighted during evening and night.

There are 3 entrances, two of them are closed, so one entrance is actually used. Entrance is equipped by the check point with the barrier; the territory is protected at night. Access roads and foot paths, and also internal thoroughfares have a firm asphalt covering.

The hospital garden is used for patients' rest, there are benches, pavilions. Medical buildings are located on the distance of 150-200 m from residential houses and 36 m from a red line of street.

Territory cleaning is spent daily. Urns are at an input in buildings and in the rest zone. The distance between platform with garbage containers and medical buildings is 100 m. A waste is taken out daily.

8. There are several zones on the territory of the hospital: the zone of the main building, the landscape gardening zone, the pathology zone, and the economic zone. There is no accurate differentiation between the specified zones. On the distance of 20-25 m from the main building there are vegetable storehouse, warehouse, laundry and disinfection unit in separate buildings. The boiler-house and garage are from southwards of the main building on the distance of 100 m. Car park is located near the main building.

9. The hospital built-up system is mixed, there is the main building consisting of three-floored administrative block and four-floored surgical

block, the pathology is located in the separate building. In the surgical block clinical and biochemical laboratories, physiotherapeutic office, massage office, electrocardiogram offices, ultrasonic, central sterilization room, visit room are on the ground floor, proctologic unit is on the 1<sup>st</sup> floor, aseptic surgical department is on the 2<sup>nd</sup> and 3<sup>rd</sup> floors, the surgery block and the resuscitation unit are on the 3<sup>rd</sup> floor.

In the administrative block on the ground floor there is drugstore, balneary, exercise therapy hall, administrative offices, and visit room, on the 1<sup>st</sup> floor - neurologic and gynecologic departments, on the 2<sup>nd</sup> floor - gastroenterologic and cardiological departments.

10. The hospital includes reception unit, ward units (surgical, proctologic, gynecologic, cardiological, gastroenterologic, neurologic), medical-diagnostic unit, pathology and other (drugstore, administrative and household premises, nutrition unit).

11. In reception there are offices of a pediatricist, a therapist, a surgeon, the duty nurse, the manager office and the head nurse's office, ante-room with an inquiry office, and sanitary room.

**12. The ward department: lay-out, ward sections; height, width, depth of wards, quantity of one-, two- and four-bedded wards, the average area and cubic capacity per 1 cot; furniture of wards, the alarm system; corridors: lateral, central, light gaps at the central corridor, width of corridor; post of duty nurse, its location, equipment; patients' day room, dining room: its size, quantity of landing places, sanitary condition; still-room: its size, equipment, sanitary condition, quality of tableware wash, food distribution; linen room, mode of linen change, linen quality and condition, lavatory: placing, isolation from wards, lay-out, sanitary condition; doctors' lounge: lay-out, sanitary appliances; premises for the duty personnel.**

13. The medical-diagnostic unit includes the surgery block, the resuscitation unit, diagnostic laboratory, unit of functional diagnostics, radiological office, unit of regenerative treatment.

The surgery block is isolated from wards. In its structure there are 5 surgery rooms (one for urgent surgery, 3 for planned surgery and one for low invasive surgery), and also preoperative, sterilization room, narcotic, sanitary room, personnel room. The resuscitation unit includes resuscitation room and wards for intensive therapy.

There is an X-ray office including medical room, management room, doctor's office and photolaboratory. The X-ray machine is in working or-



der, the effective dose of x-ray radiation of the personnel does not exceed the admissible one. The personnel are equipped with individual dosimeters. In the medical room linoleum on a floor is broken off.

The unit of functional diagnostics includes ECG and ultrasonic researches office. The unit of regenerative treatment includes physiotherapeutic and massage offices, exercise therapy hall, and balneary.

The diagnostic laboratory includes clinical and biochemical departments.

14. The pathology is located in the separate building on the distance of 80 m from the main building, and includes autopsy room, preparation room, mortuary, household premises and lobby.

15. The nutrition unit is located in the main building, it is meant for 310 cots, supplied with cold and hot water. The nutrition unit includes cooking, meat, vegetable, fish workshops, workshop of cold snack, washing room, warehouse of daily stock of products, warehouse of dry products, refrigerating chambers, vegetable storehouse and household premises. The sewage drain from the potato peeler in the vegetable workshop is spent directly on the floor. Premises of warehouse demand repair, there is no washbasin.

Cooking is spent according to the menu-apportion, 13 medical diets are used, repeatability of dishes within day is not revealed. The certification magazine is logged under the established form.

16. The disinfection unit is located in the separate one-storeyed building, it is divided into "dirty" and "clean" parts, there are two disinfecting chambers VFE-2/09, one of them is faulty.

For disinfection disinfectants are used: «Polidez», «Incrasept – A, B, T», «Sandim», « Sandim - SK» «Inklin», «Ultracide», «STEN», «Septocede - Synergy», « Septocede - Plus», hydrogen peroxide. The quarterly plan of disinfectant replacement is developed for the prevention of bacterial resistance to disinfectants.

17. The central sterilization branch includes autoclave room, located in the separate one-storeyed building. For material and rubber products sterilisation there are 3 steam sterilizers GK-100-3. For the sterilisation chemical control heat indicators are used: benzoic acid - at 120<sup>0</sup>C, urea - at 132<sup>0</sup>C. Modern multiparametrical indicators are absent. Receipt and delivery of sterilizer boxes is carried out through one door.

18. In the hospital systems of illumination, heating, ventilation, water supply and clearing are equipped. In the majority of premises illumine-

tion is both natural and artificial, light sources are luminescent lamps and incandescent lamps, lamps of diffused and direct light, illumination system are general, local and combined. Heating is central water, heating devices – batteries - are located under window sills. Ventilation is both natural and artificial, forced, exhaust and forced-air and exhaust, local and general, air-conditioning is absent. Water supply is centralized from the city waterpipe, hot and cold water is available. Clearing of firm wastes is containerized, from liquid - floatable, local treatment facilities are not present.

**19. The ward department: water supply; water drain; clearing of firm waste; illumination: building orientation, windows, blackout by the nearby buildings, angle of light incidence and aperture angle, light factor and factor of natural illumination in wards, treatment room, doctor's lounge; artificial illumination, type of lamp, its sufficiency, localization; heating: central, type and arrangement of heating devices in wards, treatment room, doctor's lounge, its serviceability, efficiency, adjustability; ventilation: general, local, natural, artificial, forced, exhaust, serviceability, frequency rate of air exchange in wards, treatment room, doctor's lounge, presence of window leaves, airing mode; microclimate in wards, treatment room, doctor's lounge.**

20. Walls of the main building are made of brick and plastered from the inside, walls in premises are covered with oil paint, dampness is not found out. In surgery rooms walls are covered with marble tile. In toilets, bathing and other premises with raised humidity and demanding frequent damp cleaning and wall disinfection the walls are covered with glazed tile. Floors are covered with linoleum, ceilings – with water-emulsive paint.

**21. The ward department: furnish of floors, walls, ceilings in wards, treatment room, doctor's lounge.**

22. Primary morbidity of the personnel is 66 cases and general - 822 cases per 1000 persons.

23. The premises of the hospital are kept clean and are exposed to regular damp cleaning with application washers and disinfectants. Desinsection, deratization and disinfection are spent in the hospital.

**24. The ward department: the maintenance; current and general cleaning; washers and disinfectants; quality of current cleaning; desinsection, deratization and disinfection carrying out; personal hygiene rules maintenance.**

25. The conclusion about lay-out, sanitary improvement and maintenance of the hospital and the ward department.

26. Offers about lay-out, sanitary improvement and maintenance of the hospital and the ward department improvement.

27. Inspection date. The signature.

**Comments:**

**1. Points 12, 19, 21, 24 of the certificate are filled by students independently after inspection of one of the department of a therapeutic or surgical profile.**

**2. The conclusion about lay-out, sanitary and technical accomplishment and maintenance of the hospital and the ward department and offers about its improvement should be represented in detail on each point of the certificate.**

**The literature.**

1. Lectures № 6, 7.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 97-124.

**Laboratory classes № 28.****The topic: HYGIENIC ESTIMATION OF CHILDREN'S PHYSICAL DEVELOPMENT**

*The theme has great value for the further training at departments of public health and public health services, pediatrics department, in practical work of a doctor for maintenance and strengthening of children's health.*

**Aim of the Lesson:** to be able to assess children's state of health and to propose actions for its improvement.

**Checking Questions.**

- ✓ 1. Health services of children and teenagers. Hygiene of children and teenagers as a science, its purpose and tasks.
- ✓ 2. Basic laws of growth and development of children.
- ✓ 3. Physical development of children and teenagers as one of health indicators.
- ✓ 4. Acceleration of physical development of children and teenagers and its socially-hygienic value.
- ✓ 5. Hygienic problems of school maturity.
- ✓ 6. Methods of studying and estimation of physical development of children and teenagers.

**Multiple Choice Questions.****Choose proper answers**

1. Health services of children and teenagers provides:
  - 1) during 1 year of a life mother with the child visits the doctor in a children's polyclinic 2 times a year;
  - 2) a doctor examines children of two years 2 time a quarter;
  - 3) children of 3-7 years are examined by doctor 2 times a year;
  - 4) during 1 year of a life mother with the child visits the doctor in a children's polyclinic monthly;
  - 5) a doctor examines children of two years 2 time a quarter.
2. Duties of a doctor of children's organization are:
  - 1) hygienic training and education;
  - 2) planned revaccination;
  - 3) actions for physical and labour education;

- 4) actions for hygiene of training;
- 5) control of children's personal hygiene.
- 3.** Dispensary observation should examine:
  - 1) children with a tuberculosis;
  - 2) healthy children;
  - 3) children with mental diseases;
  - 4) children of sport section;
  - 5) children with sight, hearing and speech loss.
- 4.** Hygiene of children and teenagers is a section of hygiene studying:
  - 1) laws of environment factors' influence on children's health up to 18 year old age;
  - 2) condition of its maintenance;
  - 3) moral development of children;
  - 4) harmonious physical and intellectual development;
  - 5) mental development of children.
- 5.** Laws of growth and development of children are:
  - 1) development of the musculoskeletal system;
  - 2) dependence of growth and development processes on age;
  - 3) dependence of growth and development processes on sex;
  - 4) tripling of body weight at 12 months;
  - 5) non-uniformity of growth and development processes.
- 6.** The criteria characterizing health level of children are:
  - 1) chronic or acute diseases;
  - 2) functional state of organism systems;
  - 3) level and degree of a mental development harmony;
  - 4) level and degree of a physical development harmony;
  - 5) degree of organism's resistance.
- 7.** Health groups of children and teenagers are:
  - 1) healthy;
  - 2) healthy with functional and some morphological deviations;
  - 3) compensative chronic diseases and children with some physical defects;
  - 4) subcompensative chronic diseases;
  - 5) decompensative chronic diseases, invalids of 1 and 2 groups.
- 8.** For the characteristic of physical development the following criteria are used:
  - 1) somatic;
  - 2) anthropometric;
  - 3) functional state of central nervous system;
  - 4) physiological;

- 5) functional state of autonomic nervous system.
- 9.** Anthropometric indicators of physical development are:
- 1) height;
  - 2) weight;
  - 3) sexual development;
  - 4) functional state of central nervous system;
  - 5) vital capacity of lungs.
- 10.** Acceleration of physical development is characterized by:
- 1) acceleration of growth;
  - 2) earlier puberty;
  - 3) increase of body weight;
  - 4) increasing levels of child morbidity;
  - 5) increase of infectious diseases.
- 11.** School maturity is:
- 1) functional readiness of child's body to a systematic training in school in a healthy way;
  - 2) structural readiness of locomotor system to learn in a healthy way;
  - 3) physiological readiness of circulatory and respiratory systems to training without injury;
  - 4) functional readiness of child's organism body for regular training at school;
  - 5) corresponded to physical development of a child's age.
- 12.** Features of nutrition of children and teenagers:
- 1) should correspond to all principles of balanced diet;
  - 2) parity between proteins, fats and carbohydrates in the diet of children and teenagers makes 1:1:4;
  - 3) within the first 3 years of life a child receives all daily diet in the uniform portions within day;
  - 4) should consumpt the equivalent of about 500 ml of milk a day for preschool children;
  - 5) meat, fish and alternatives should be eaten once or twice a day for preschool children.
- 13.** Types of physical development of children and teenagers are:
- 1) very disharmonious;
  - 2) harmonious (normal);
  - 3) disharmonious;
  - 4) physiological;
  - 5) functional.

**14.** The acceleration reasons are:

- 1) improvement of food and its rationality;
- 2) change of background of space radiation and lengthening of "light day»;
- 3) influence of a city way of life;
- 4) endogenic;
- 5) strengthening of heterozygosis arising owing to increase of marriage communications between earlier isolated groups of the population.

**15.** Children school maturity groups are:

- 1) risk group;
- 2) children with development defects;
- 3) children ready to training;
- 4) children with backlog of physical and mental development, functional deviations and chronic diseases;
- 5) degree of functional maturity, physical development, state of health and psychophysiological development are low.

### **Laboratory Work.**

- 1. Determine individual height, weight, thorax circle, vital capacity of lungs, strength of hand.
- 3. Estimate the received results.
- 4. Offer actions for optimization of physical development.
- 5. Registrare the laboratory work report.

### ***Determination of height.***

Equipment: heightmeter (figure 28).

Work performance: individual height is measured by means of height meter:

- at height measurement in *standing pose* the student stands, hands on seams, heels together, socks separately, thus he touches the heightmeter's racks with heels, buttocks and intrascapular area, the head is slightly inclined in such a way that a line from an tragus upper edge to a bottom edge of an eye-socket is at horizontal level, in parallel floor plane, heightmeter's ruler is lowered on a top point of a head;

- at height measurement in *sitting pose* the student sits down on a heightmeter's bench, thus he touches the heightmeter's racks with buttocks and intrascapular area, head position is the same with height measurement in standingpos, feet are bent in a knee joint, hands lay along hips.

***Determination of a body weight.***

Equipment: medical scales (figure 29).

Work performance: the student should be on empty stomach, without clothes and footwear, scales point is put on zero, the student stands on the middle of the scales platform, scales is counterbalanced with movable weights.



**Figure 28.** Heightmeter.

***Determination of thorax circle.***

Equipment: centimeter, roulette.

Work performance: the centimeter is imposed behind on the bottom angle of scapulas with lifted hands. After imposing of the centimeter hands are



lowered down and the centimeter, sliding off, lays down under angle of scapulas. At men and children the centimeter should be placed at the level of the lower edge of nipple, and at girls - on the level of IV rib. The thorax circle should be measured in rest, during maximum breath in and breath out.



**Figure 29.** Medical scales.

***Determination of vital capacity of lungs.***

Equipment: spirometer (lung-tester) (figure 30).

Work performance: turning the cover it is necessary to fix the lung-tester scale so that the arrow will coincide with zero division of the scale. The maximum breath is made, having held the breath, the mouthpiece is densely clasped and all air through the mouth is exhaled in the tube.

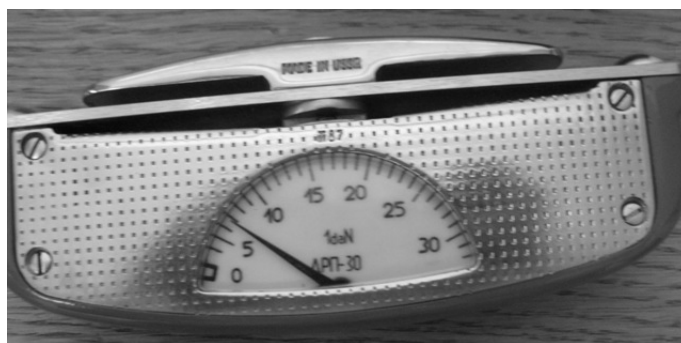


**Figure 30.** Spirometer.

### *Determination of force of hand.*

Equipment: manual dynamometer (figure 31).

Work performance: the arrow of dynamometer is put in zero position, hand is lifted aside and the dynamometer spring is compressed as strong as possible.



**Figure 31.** Manual dynamometer.

### *Hygienic estimation.*

The received results of height, weight of body, thorax circle, vital capacity of lungs, forces of hand are estimated by method of sigma deviations.

In compliances with height group of the student (tables 3, 4) standards of physical development of the studied signs developed separately for students aged from 19 till 25 years are written out from the tables. Thus indicators of the student and standards are registered, the difference of each sign which is divided into the average quadratic deviation (the general sigma) is found and sigma deviation is calculated.

**Table 3** - Growth anthropometric standards of Gomel University students in 1971-1980 ( $M \pm \sigma$ ) (men).

Height group, cm	Height, cm		Weight of body, kg	Force of hand, Kg		Vital capacity of lungs, ml	Thorax circle, cm		
	standing pose	sitting pose		right	Left		inhale	exhale	pause
161-165	163±2,8	88±1,9	64,2±2,8	53,0±7,3	52±8,1	4200±300	97,5±3, 1	90 ±2,7	93,2±3,4
166-170	168,3±2,4	90,5±2	66,5±2,7	54±7,5	53,0±6,9	4900±500	98,2±3,2	91,0±2,4	93,5±3,1
171-175	173,1±2,3	91,7±1,8	71,2±2,4	58 ± 7,8	55 ±7,8	4900±540	99,7±2,5	91,5±2,9	95 ±2,2
176-180	178,4±1,8	93,8±1,6	76,3±2,2	60 ± 6,4	57 ±8,2	5250±560	102,4±2,9	94±2,9	97,2±1,6
181-185	183,2±2,1	95 ± 2	79,2±2,4	60,5±5,8	58 ±5,7	5500±560	103,4±3.2	95,2±2,5	98,5±3,1
186-190	188,1±1,7.	97,7±1,9	82,8±2	61 ±4,8	59 ±5,6	5900±300	103,5±3	95,7±2,2	99 ±2,9
191-195	193,3±2,2	98,6±2,1	85,3±2,2	62 ± 6,8	60 ±6,3	6100±550	104 ±3,4	95 ±2,9	99,2±3

**Table 4** - Growth anthropometric standards of Gomel University students in 1971-1980 ( $M \pm \sigma$ ) (women).

Height group, cm	Height, cm		Weight of body, kg	Force of hand, kg		Vital capacity of lungs, ml	Thorax circle, cm		
	standing pose	sitting pose		right	left		inhale	exhale	pause
151-155	154,2 $\pm$ 1,8	83,1 $\pm$ 1,6	53 $\pm$ 3,6	28 $\pm$ 4,7	26 $\pm$ 4,6	2950 $\pm$ 280	90 $\pm$ 2,9	82 $\pm$ 2,5	85 $\pm$ 1,1
156-160	158,3 $\pm$ 1,5	84,9 $\pm$ 1,8	57,4 $\pm$ 2,6	32 $\pm$ 3,5	31 $\pm$ 3,4	3200 $\pm$ 300	91 $\pm$ 3,9	83 $\pm$ 2,2	88 $\pm$ 2
161-165	164,4 $\pm$ 2	87 $\pm$ 1,7	61 $\pm$ 3	37 $\pm$ 3,4	36 $\pm$ 3,9	3500 $\pm$ 350	95 $\pm$ 3,4	86 $\pm$ 3,2	90 $\pm$ 2,4
166-170	165,6 $\pm$ 2	88,3 $\pm$ 1,6	65,3 $\pm$ 3,6	40 $\pm$ 3,3	38 $\pm$ 3,8	3800 $\pm$ 360	96,5 $\pm$ 3,9	89 $\pm$ 2,2	92 $\pm$ 1,3
171-175	172,4 $\pm$ 1,9	89 $\pm$ 1,7	70,2 $\pm$ 4,6	40,5 $\pm$ 2	39 $\pm$ 3,6	4100 $\pm$ 350	97,5 $\pm$ 3,8	90 $\pm$ 2,9	93 $\pm$ 1,5
176-180	175,7 $\pm$ 2,1	90,2 $\pm$ 1,6	77,5 $\pm$ 3,6	44 $\pm$ 3	41 $\pm$ 2,6	4300 $\pm$ 280	99 $\pm$ 3,7	91 $\pm$ 2,4	94 $\pm$ 1,8

*Each indicator is separately estimated on the scale:*

- $1\sigma$  -  $+1\sigma$  – average value;
- $1\sigma$ - $2\sigma$  – indicator is lower than average;
- $2\sigma$ - $3\sigma$  and less – the lowest indicator;
- $+1\sigma$  -  $+2\sigma$  – indicator is higher than average;
- $+2\sigma$  -  $+3\sigma$  and more – the highest indicator.

*Then the harmony of physical development as a whole according to the scale is estimated:*

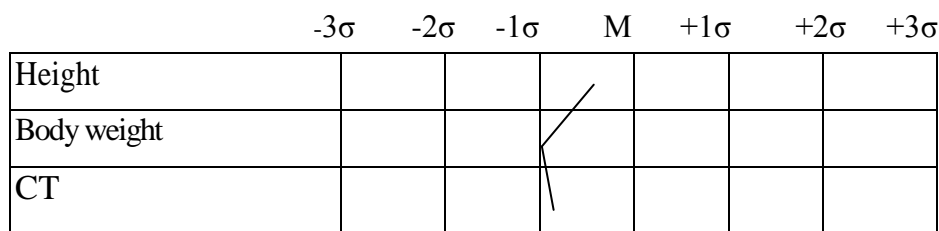
- $1\sigma$  -  $+1\sigma$  - harmonious development;
- $2\sigma$  -  $+2\sigma$  - disharmonious development;
- $3\sigma$  and more low -  $+3\sigma$  and above - very disharmonious development.

**The example** of estimation of physical development of the student 20 years old by the method of sigma deviations with the subsequent graphic representation of a profile of physical development is resulted in the table 5. Height of the student (172 cm) concerns to height group 171-175 cm (table 3), on it find standards and sigma.

The graphic representation of a profile of the physical development constructed on received data (height, body weight, circle of thorax circle), is resulted in picture 1.

**Table 5.** Estimation of physical development of the student

Indicators (A)		Standart (M)	Sigma	Difference (A – M)	Sigma deviations
Height, cm	172	173.1	2,3	-1,1	-0,5
Body weight, kg	68.8	71,2	2,4	-2,4	-1,0
Force of hand, kg:					
right	56.0	58,0	7,8	-2,0	-0,3
VLC, ml	4400	4900	540	-500	-0,9
CT, cm:					
pause	93	95,0	2,2	-2,0	-0,9

**Grafh 1.** Profile of physical development.

Height, weight of body, thorax circle, force of a hand, VLC of the student - average indexes. The received curve testifies that physical development of the given student harmonious, however is planned some tendency to disproportionate development. The weight of body and thorax circle in comparison with height are more underestimated, that can take place at an insufficient food and employment by physical culture.

**Solve a problem, estimate the obtained data and request actions for their improvement**

### Situational Task.

A boy of city school, 10 years old has 131.5 cm height, body weight – 23.5 kg, round of thorax - 60 cm. State the hygienic estimation of the physical development and offer improvement actions.

*The algorithm of task's solution:*

Deviation from the standard of height of the boy =  $(131.5-138.3):5.5 = -1.2 \delta$ , weight deviation =  $(23.5-32.8):5.4 = -1.7 \delta$ , deviation of round of thorax =  $(60-67.3):4.8 = -1.5 \delta$ . The physical development of the boy is below than average, disharmonious.

It is necessary to rationalize nutrition and organize employment by

physical culture and sport.

1. A girl of rural school, 9 years old has 130 cm height, body weight - 33 kg, round of thorax - 60 cm. State the hygienic estimation of the physical development and offer improvement actions.

2. A boy of rural school, 12 years old has 129 cm height, body weight - 66 kg, round of thorax - 75 cm. State the hygienic estimation of the physical development and offer improvement actions.

3. A boy of city school, 13 years old has 172 cm height, body weight - 54 kg, round of thorax - 98 cm. State the hygienic estimation of the physical development and offer improvement actions.

4. A girl of city school, 8 years old has 120 cm height, body weight - 19 kg, round of thorax - 54 cm. State hygienic estimation of physical development and offer improvement actions.

5. A boy of city school, 14 years old has 180 cm height, body weight - 70 kg, round of thorax - 92 cm. State the hygienic estimation of the physical development and offer improvement actions.

### Situational Task.

A girl, 16 years old with height - 170 cm and body weight - 50 kg consumes 58 g of proteins, 65 g of fats, 280 g of carbohydrates per day. State the hygienic estimation of the food status and diet and offer improvement actions.

*The algorithm of task's decision:*

The food status of the schoolgirl is insufficient: Broke index =  $50:(170-100)=0.7$  (normal is – 0.9-1.1). Schoolgirl's food is not adequate: she consumes less proteins (normal is 61), fats (normal is 67), carbohydrates (normal is 289). It is necessary to increase the proteins daily requirement on 3 g, fats daily requirement on 2 g, carbohydrates daily requirement on 9 g.

6. A boy, 14 years old with height - 162 cm and body weight - 50 kg consumes 70 g of proteins, 90 g of fats, 300 g of carbohydrates per day. State the hygienic estimation of the food status and diet and offer improvement actions.

7. A boy, 15 years old with height - 165 cm and body weight - 52 kg consumes 75 g of proteins, 350 g of carbohydrates, 85 g of fats, 45 mg of vitamin C, 2 mg of vitamin B<sub>1</sub>, 1,5 mg of vitamin B<sub>2</sub>, 10 mg of vitamin PP per day. State the hygienic estimation of the food status and diet and offer improvement actions.

**8.** A girl, 12 years old with height - 145 cm and body weight - 48 kg consumes 70 g of proteins, 80 g of fats, 450 g of carbohydrates per day. State the hygienic estimation of the food status and diet and offer improvement actions.

**9.** A girl, 10 years old with height - 130 cm and body weight - 34 kg consumes 65 g of proteins, 70 g of fats, 250 g of carbohydrates per day. State the hygienic estimation of the food status and diet and offer improvement actions.

**10.** A girl of 12 years old with height - 155 cm and body weight - 58 kg consumes 120 g of proteins, 120 g of fats, 480 g of carbohydrates per day. State the hygienic estimation of the food status and diet and offer improvement actions.

#### **The literature.**

1. Lecture № 8.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 125-134.

**Laboratory classes № 29.**

**The topic: HYGIENIC REQUIREMENTS TO LAYOUT,  
SANITARY-TECHNICAL ACCOMPLISHMENT, EQUIPMENTS  
AND MAINTENANCE OF EDUCATION INSTITUTIONS**

*The theme has great value for the further training at pediatrics department, in practical work of a doctor for optimization of children's stay conditions in preschool and school education institutions, prevention of diseases of children and teenagers.*

**Aim of the Lesson:** to be able to estimate layout, sanitary-technical accomplishment and maintenance of education institutions and to propose actions for its improvement.

**Checking Questions.**

- ✓ 1. Hygienic principles of layout and building of preschool institutions and schools. Hygienic requirements to choice, layout and building of the ground area of preschool institutions and schools.
- ✓ 2. Hygienic requirements to internal layout, furnish and equipment of children's preschool institutions.
- ✓ 3. Hygienic requirements to internal layout, furnish and equipment of schools.
- ✓ 4. Hygienic requirements to microclimate, sanitary-engineering accomplishment, keeping and cleaning of preschool institutions.
- ✓ 5. Hygienic requirements to microclimate, sanitary-engineering accomplishment, keeping and cleaning of schools.
- ✓ 6. Methods of studying and estimation of layout, sanitary-technical accomplishment and maintenance of schools and preschool institutions.

**Multiple Choice Questions.**

**Choose proper answers**

1. Hygienic principles of designing and building of a kindergarten are:
  - 1) creation of group isolation in a building and on a site;
  - 2) maintenance of conditions for impellent activity of children;
  - 3) creation of a favorable air-thermal mode;
  - 4) maintenance of sufficient insolation;
  - 5) creation of conditions for a balanced diet.
2. Requirements to preschool institution ground area are:
  - 1) 10-20 m<sup>2</sup> per 1 child;

- 2) 30-50 m<sup>2</sup> per 1 child;
  - 3) level of standing of subsoil waters is not less than 1.5 m;
  - 4) the noise level on a site should not exceed 45 db;
  - 5) the noise level on a site should not exceed 80 db.
- 3. Requirements to preschool institution ground area built-up:**
- 1) the area of green plantings is 30% and more;
  - 2) the area of green plantings is 40% and more;
  - 3) the area of green plantings is 50% and more;
  - 4) the area of building is 10-12%;
  - 5) the area of building is 15-20%.
- 4. Zones of school ground area are:**
- 1) training;
  - 2) sports;
  - 3) gaming;
  - 4) economic;
  - 5) rest.
- 5. Proper microclimate parameters for preschool institutions are:**
- 1) temperature – 15-18<sup>0</sup>;
  - 2) temperature - 19-22<sup>0</sup>;
  - 3) temperature – 23-26<sup>0</sup>;
  - 4) relative humidity – 20-30 %;
  - 5) relative humidity - 30-60 %.
- 6. Hygienic requirements to equipment of schools:**
- 1) desks are placed at the distance of 0.3 m from each other;
  - 2) desks are placed at the distance of 0.5 m from each other;
  - 3) the distance from the first tables to blackboard should be 1.6-2.4 m;
  - 4) the distance from the first tables to blackboard should be 2.4-2.6 m;
  - 5) children's placement should be taking into account height, visual acuity and hearing.
- 7. Groups of preschool furniture are:**
- 1) 00 - for children with height 85 cm;
  - 2) 0 - for children with height 85-100 cm;
  - 3) 1 - for children with height 100-115 cm;
  - 4) 2 - for children with height 115-130 cm;
  - 5) 3 - for children with height above 130 cm.
- 8. Group cells of junior group (10-15 places) include:**
- 1) buffet;
  - 2) reception;



- 3) playing;
  - 4) bedrooms;
  - 5) toilet.
- 9.** Group cells of senior groups (20 places) include:
- 1) buffet;
  - 2) reception;
  - 3) group-room with a rest zone;
  - 4) toilet relative;
  - 5) playing.
- 10.** School premises are:
- 1) basic;
  - 2) auxiliary;
  - 3) office;
  - 4) rest;
  - 5) sport.
- 11.** Parameters of the basic premises of school are:
- 1) minimum area for 1 person in a class -  $2 \text{ m}^2$ ;
  - 2) area of a class room -  $50\text{-}54 \text{ m}^2$ ;
  - 3) depth of a class room – 6 m;
  - 4) length of a class room -  $8\text{-}8,4 \text{ m}$ ;
  - 5) premise's volume -  $6 \text{ m}^3$  per one pupil at 3 m height.
- 12.** Basic school premises are:
- 1) educational classes;
  - 2) educational offices of language, literature, history, geography, mathematics, plotting and drawing;
  - 3) laboratory of chemistry, physics and biology;
  - 4) workshops;
  - 5) sports hall.
- 13.** Illumination of preschool institutions is:
- 1) natural;
  - 2) artificial;
  - 3) central;
  - 4) local;
  - 5) centralized.
- 14.** The illumination in preschool institutions should be not less than:
- 1) 300 lux in group room, playing room, musical and gymnastic halls using luminescent lamps;
  - 2) 50 lux in bedrooms using luminescent lamps;

- 3) 150 lux in group room, playing room, musical and gymnastic halls using incandescent lamp;
  - 4) 75 lux in bedrooms using incandescent lamp;
  - 5) 100 lux in bedrooms using luminescent lamps.
- 15.** Objects of general cleaning of preschool institutions premises are:
- 1) floors;
  - 2) windows;
  - 3) doors;
  - 4) walls;
  - 5) lighting armature.

### **Laboratory Work.**

- 1. Determine size of pupil's desk and chairs.
- 2. Estimate the received results.
- 3. Offer actions for improvement of size of pupil's desk and chairs.
- 4. Record the laboratory work report.

#### *Determination of pupil's desk and chairs sizes.*

Equipment: tape measure, ruler, heightmeter.

Work performance:

- a. chair parameters such as chair bottom height, chair depth, chair width, chair back height are measured;
- b. desk parameters such as desk cover height, desk width, desk length and desk inclination angle are measured;
- c. parameters of chair and desk interposition such as chair bottom distance, chair back distance, differential are measured.
- d. pupil's height, forearm and hand length, shank and foot length, thigh length, anterior-posterior thorax length are measured.

#### *Hygienic estimation.*

Parameters of chair

- a chair bottom height = shank and foot length + heel height
- a chair bottom depth =  $\frac{3}{4}$  of a thigh length
- a chair bottom width =  $\frac{1}{2}$  of hips circumference + 5 cm
- a chair back height should come up to lumbar flexure

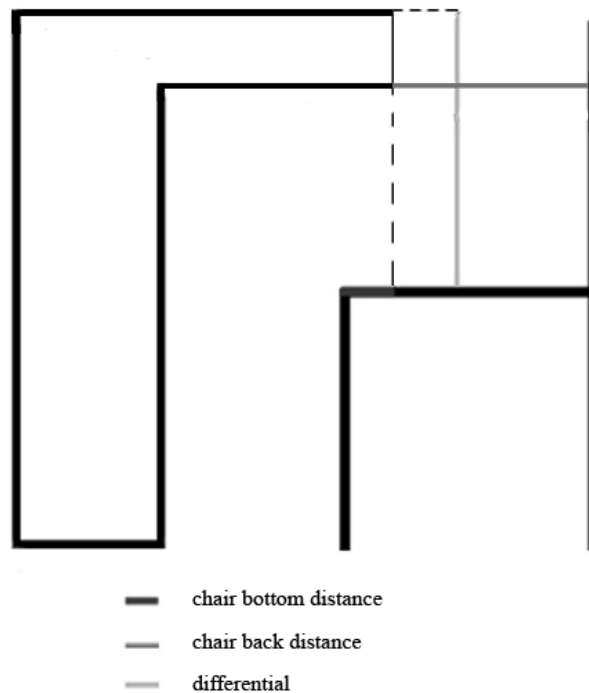
Parameters of desk

- a desk cover width should provide arms and books placement
- a desk cover length = (forearm and hand length) × 2

- a desk cover inclination angle = 14-15°

Interposition of desk and chair (figure 32).

- a chair bottom distance = -5 cm
- a chair back distance = anterior-posterior thorax length = 5 cm
- differential = 1/7 – 1/8 of a pupil's height



**Figure 32.** Interposition of desk and chair.

**Solve a problem, estimate the obtained data and request actions for their improvement**

### **Situational Task.**

In the classroom for 40 pupils temperature is 24°C, humidity is 70%, air movement rate is 0.02 m/s. Estimate the microclimate of the classroom and offer actions for its improvement.

*The algorithm of task's solution:*

Microclimatic conditions in the class do not correspond to the hygienic requirements: temperature is raised (normal is 18-20°C), relative humidity is raised (normal is 30-60 %), speed of air movement is in normal

limits (normal is 0.06 – 0.25 m/s). The microclimate in the class is overheating.

It is necessary to observe airing regimen of classes, spend airing during breaks, decrease the quantity of pupils in the class.

**1.** The secondary school has territory site with 10 m<sup>2</sup> per one pupil. It is divided into sport, rest and experimental zones and economic yard. Total area of the site includes 30% of green plantings and 20% of buildings. Estimate the planning of the territory site and offer actions for its improvement.

**2.** In the kindergarten in the structure of premise for preschool group there is group room, clothing-room, toilet and bedroom. Group room is focused to the north; its square is 2 m<sup>2</sup> per 1 child. Estimate the planning of the premise for preschool group and offer actions for its improvement.

**3.** In the classroom of primary school light factor is 1/6, angle of light incidence is 25°, aperture angle is 5°, natural illumination factor is 0.5%. Estimate the classroom of primary school and offer actions for its improvement.

**4.** In the classroom of primary school natural illumination factor is 1%, light factor is 1/7, artificial illumination by luminescent lamps is 200 lx. Estimate the classroom of primary school and offer actions for its improvement.

**5.** The square of the classroom for 38 students is 52 m<sup>2</sup>, temperature is 26°C, humidity is 75%, air movement rate is 0.01 m/s. Estimate the planning and microclimate of the classroom and offer actions for its improvement.

**6.** In the kindergarten in the structure of premise for average group there is lobby, group room, clothing-room, toilet, bedroom, dining room. Group room is focused to the south; its square is 2.5 m<sup>2</sup> per 1 child. Estimate the planning of the premise for average group and offer actions for its improvement.

**7.** In the classroom of secondary school light factor is 1/8, natural illumination factor is 1.5%, illumination with luminescent lamps is 150 lx. Estimate the illumination of the classroom and offer actions for its improvement.

**8.** In the classroom of secondary school light factor is 1/7, natural illumination factor is 1%, illumination with luminescent lamps is 200 lx. 25% of pupils studying here suffer from myopia (nearsightedness). Estimate

**Hygienic requirements to lay out, sanitary-technical accomplishment, Laboratory classes №29 equipments and maintenance of education institutions**

mate the illumination of the classroom and offer actions for its improvement.

**9.** In the classroom illumination with luminescent lamps is 150 lx, light factor is 1/6, ventilation rate is +1–0.5. Estimate the illumination and ventilation of the classroom and offer actions for its improvement.

**10.** In the classroom light factor is 1/7, natural illumination factor is 1%, illumination with luminescent lamps is 180 lx, ventilation rate is +1–1, temperature is 17°C. Estimate the illumination and ventilation of classroom and offer actions for its improvement.

**The literature.**

1. Lecture № 8.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 134-137.

**Laboratory classes № 30.**

**The topic: HYGIENIC REQUIREMENTS TO TEACHING  
PROCESS OF EDUCATION INSTITUTIONS**

*The theme has great value for the further training at pediatrics department, in practical work of a doctor for optimization of children training in preschool and school education institutions, prevention of diseases of children and teenagers.*

**Aim of the Lesson:** to be able to estimate teaching process of education institutions and to propose actions for its improvement.

**Checking Questions.**

- ✓ 1. Laws of working capacity of children and teenagers. Regimen of day.
- ✓ 2. Hygienic requirements to organization of teaching and educational process in preschool institutions.
- ✓ 3. Hygienic requirements to organization of teaching and educational process at schools.
- ✓ 4. Hygienic estimation of handwork and industrial training of children and teenagers. Hygienic bases of professional orientation.
- ✓ 5. Hygienic estimation of physical training of children and teenagers.
- ✓ 6. Methods of studying and estimation of teaching and educational process.

**Multiple Choice Questions.**

**Choose proper answers**

1. Requirements to lessons duration in kindergartens are:
  - 1) in younger group lessons last 10-15 minutes;
  - 2) in senior group 2 lessons last 25 and 20 minutes;
  - 3) in preparatory group 3 lessons last 20, 25 and 30 minutes;
  - 4) breaks should be 10-12 minutes;
  - 5) homework in all groups are not set.
2. Hygienic requirements to a school timetable:
  - 1) lesson's duration in the 1<sup>st</sup> class is recommended no more than 35 minutes;
  - 2) lesson's duration in 2-11 classes should be 45 minutes;
  - 3) difficult subjects are forbidden on Monday and Saturday;

- 4) difficult subjects are forbidden on Tuesday and Wednesday;
- 5) it is necessary to alternate the subjects.
- 3.** Groups of schoolchildren for lesson of physical activity are:
  - 1) basic;
  - 2) main;
  - 3) preparatory;
  - 4) special;
  - 5) weak.
- 4.** Tempering (health promotion) is:
  - 1) a system of procedures directed on formation of organism's stability to adverse meteorological factors;
  - 2) douche with cool water;
  - 3) a system of physical exercises directed on formation of organism's stability to microorganisms;
  - 4) personal hygiene;
  - 5) a component of physical training.
- 5.** The main principles of tempering (health promotion) are:
  - 1) systematic character;
  - 2) step-by-step dosage increase;
  - 3) considering of organism's specific features;
  - 4) variety of means and forms of tempering;
  - 5) combination of general and local procedures.
- 6.** A chair bottom depth should be:
  - 1) shank and foot length + heel height;
  - 2)  $\frac{3}{4}$  of a thigh length;
  - 3)  $\frac{1}{2}$  of hips circumference + 5 cm;
  - 4) 5 cm;
  - 5) anterior-posterior thorax length - 5 cm.
- 7.** Educational process must provide:
  - 1) health of pupils;
  - 2) prevention of fatigue;
  - 3) motor activity;
  - 4) optimal information value;
  - 5) maintaining of working capacity.
- 8.** The highest working capacity of pupils is noted on:
  - 1) 1 lesson ;
  - 2) 2-3 lesson;
  - 3) 4 lesson;
  - 4) 5 lesson;

- 5) 6 lessons.
- 9.** Purposes of physical education for children and adolescents are:
- 1) health promotion, improvement of physical development, increase the body's resistance;
  - 2) formation of motor skills;
  - 3) education of activity, discipline;
  - 4) development of skills for systematic exercise and tempering;
  - 5) development of certain kinds of sport.
- 10.** Rational regimen of pupils' day includes:
- 1) proper organization of lessons;
  - 2) valuation of lessons;
  - 3) regulation of lessons' duration;
  - 4) management of construction activities;
  - 5) duration of holidays.
- 11.** Professional orientation of teenagers includes:
- 1) study of society needs for specialists;
  - 2) study of personality of pupils;
  - 3) formation of a professional orientation;
  - 4) determining suitability of patients;
  - 5) professional selection of healthy people.
- 12.** Education and training in child care centers are:
- 1) physical;
  - 2) moral;
  - 3) aesthetic;
  - 4) hygienic;
  - 5) labor.
- 13.** Handwork lessons:
- 1) lessons has influence on nervous and muscular systems, coordination;
  - 2) muscular endurance of pupils after work lessons increases by 13-22 %;
  - 3) are spent for pupils of 1-4 classes 2 times a week for 45 minutes;
  - 4) are spent for pupils of 5-7 classes employment by work once a week in the form of dual lessons;
  - 5) general duration of practical work for pupils of 1-2 classes should not exceed 20-25 min, for pupils of 3-4 classes - 30-35 min of lesson time.
- 14.** Physical training principles are:



- 1) integrated approach;
- 2) gradual transition from small loading to large;
- 3) system;
- 4) account of functionality's of organism;
- 5) unfavorable conditions of environment.

**15. Structure of lesson of work is:**

- 1) beginning;
- 2) theoretical part;
- 3) practical work;
- 4) breaks;
- 5) final part.

**Laboratory Work.**

- 1. Study the school time-table.
- 2. Estimate the received results.
- 3. Offer actions for the school time-table optimization.
- 4. Record the laboratory work report.

*Studying of the school time-table.*

Equipment: school time-table, difficulty scale.

Work performance:

Time of classes beginning, classes duration, classes distribution according to the difficulty scale, time of classes ending, presence of breaks, its duration are defined.

<b>DIFFICULTY SCALE</b>		
<b>Subject</b>		<b>Points</b>
1	Mathematics, Russian (for national schools)	11
2	Foreign language	10
3	Physics, chemistry, computer science	9
4	History	8
5	The native language and literature	7
6	Natural sciences, geography	6
7	Physical training	5
8	Work	4
9	Plotting	3
10	Drawing	2
11	Singing	1

*Hygienic estimation.*

The received results are compared with SanRandN № 206, 27.12.2012.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

The timetable on Monday for students of 11<sup>th</sup> class of the secondary school is the following: 1<sup>st</sup> lesson is algebra, 2<sup>nd</sup> – physical education, 3<sup>rd</sup> – russian language, 4<sup>th</sup> – physics, 5<sup>th</sup> – native language, 6<sup>th</sup> – handicraft, 7<sup>th</sup> – chemistry. Estimate the timetable and offer actions for its improvement.

*The algorithm of task's solution:*

The schedule of lessons on Monday in 11 class mismatches hygienic requirements: quantity of lessons is great (normal is 6), the first lesson algebra and the last lesson chemistry are very difficult and estimated as 11 and 9 points accordingly.

It is recommended to spend on Monday 6 lessons according to the difficulty scale: 1<sup>st</sup> lesson - history (8 points); 2<sup>nd</sup> lesson - algebra (11 points); 3<sup>rd</sup> lesson - russian (11 points); 4<sup>th</sup> lesson - physical education (5 points); 5<sup>th</sup> lesson - physics (9 points); 6<sup>th</sup> lesson - work (4 points).

**1.** The timetable on Monday for pupils of 4<sup>th</sup> class of the primary school is the following: 1<sup>st</sup> lesson is music, 2<sup>nd</sup> – physical education, 3<sup>rd</sup> – mathematics, 4<sup>th</sup> – russian language, 5<sup>th</sup> – handicraft. Estimate the timetable and offer actions for its improvement.

**2.** On Monday in 10 class according to the schedule 1<sup>st</sup> lesson is history, 2<sup>nd</sup> - physical education, 3<sup>rd</sup> - russian, 4<sup>th</sup> - physics, 5<sup>th</sup> - belarus language, 6<sup>th</sup> - work, 7<sup>th</sup> - algebra. Estimate the timetable and offer actions for its improvement.

**3.** On Monday in 9 class according to the schedule 1<sup>st</sup> lesson is algebra, 2<sup>nd</sup> - physical education, 3<sup>rd</sup> - foreign language, 4<sup>th</sup> - chemistry, 5<sup>th</sup> - belarus language, 6<sup>th</sup> - physics. Estimate the timetable and offer actions for its improvement.

**4.** On Monday in 7 class according to the schedule 1<sup>st</sup> lesson is natural sciences, 2<sup>nd</sup> - russian, 3<sup>rd</sup> - physical education, 4<sup>th</sup> - physics, 5<sup>th</sup> - belarus language, 6<sup>th</sup> - singing. Estimate the timetable and offer actions for its improvement.

**5.** On Monday in 11 class according to the schedule 1<sup>st</sup> lesson is algebra, 2<sup>nd</sup> - singing, 3<sup>rd</sup> - russian, 4<sup>th</sup> - chemistry, 5<sup>th</sup> - physical education, 6<sup>th</sup> - work, 7<sup>th</sup> - history. Estimate the timetable and offer actions for its improvement.

**6.** On Monday in 10 class according to the schedule 1<sup>st</sup> lesson is history, 2<sup>nd</sup> - physical education, 3<sup>rd</sup> - russian, 4<sup>th</sup> - chemistry, 5<sup>th</sup> - belarus language, 6<sup>th</sup> - work, 7<sup>th</sup> - algebra, on algebra control examination is spent. Estimate the timetable and offer actions for its improvement.

**7.** On Monday in 9 class according to the schedule 1<sup>st</sup> lesson is algebra, 2<sup>nd</sup> - physical education, 3<sup>rd</sup> - foreign language, 4<sup>th</sup> - chemistry, 5<sup>th</sup> - belarus language, 6<sup>th</sup> - physics, on physics control examination is spent. Breaks between lessons are 5 minutes. Estimate the timetable and offer actions for its improvement.

**8.** The timetable on Tuesday for pupils of 3<sup>th</sup> class of the primary school is the following: 1<sup>st</sup> lesson is mathematics, 2<sup>nd</sup> – physical education, 3<sup>rd</sup> – music, 4<sup>th</sup> – russian language, 5<sup>th</sup> – handicraft. Estimate the timetable and offer actions for its improvement.

**9.** On Wednesday in 11 class according to the schedule 1<sup>st</sup> lesson is russian, 2<sup>nd</sup> - algebra, 3<sup>rd</sup> – physics, 4<sup>th</sup> - belarus language -, 5<sup>th</sup> - handicraft, 6<sup>th</sup> – history. Estimate the timetable and offer actions for its improvement.

**10.** On Monday in 6 class according to the schedule 1<sup>st</sup> lesson is belarus language, 2<sup>nd</sup> - geography, 3<sup>rd</sup> - math, 4<sup>th</sup> - physical education, 5<sup>th</sup> - chemistry, 6<sup>th</sup> - english. Estimate the timetable and offer actions for its improvement.

#### **The literature.**

1. Lecture № 8.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 137-141.

**Laboratory classes № 31.****The topic: FINAL CONTROL STUDY OF CLASSES OF HYGIENE OF HEALTH CARE ORGANIZATIONS AND RISING GENERATION**

*The theme has important value for further training at department of organization of public health services and public health, therapy department, in practical work in optimization of treatment-improving process and working conditions of personnel.*

**Aim of the Lesson:** to be able to assess lay-out and placement, ventilation, heating and microclimate, illumination and water supply, maintenance and disposal of hospitals, out-patient-polyclinic organizations, spend sanitary inspection of public health services organizations, children's state of health, planning, sanitary-technical accomplishment and keeping of education institutions, teaching process and to propose actions for its rationalization.

**Checking Questions.**

1. The role of optimum lay-out and placement of hospitals. Hygienic requirements to choice and planning of hospital's ground area.
2. Systems of hospital's build-up. Features of modern hospital construction.
3. Features of lay-out of reception and pathoanatomical department of hospital.
4. Medical-diagnostic unit of hospital.
5. Hygienic requirements to surgery block lay-out.
6. Hygienic requirements to ward section.
7. Features of therapeutic and surgical department's planning.
8. Features of obstetric and gynecologic department's planning.
9. Features of infectious and children department's planning.
10. Features of lay out and work regimen of radiological department.
11. Hospital's heating and ventilation, its hygienic meaning.
12. Hygienic requirements to hospital's heating.
13. Hygienic requirements to hospital's ventilation.
14. Air conditioning in hospital's premises.
15. Microclimate of hospitals and its hygienic value. Joint influence of microclimate factors.
16. Illumination and water supply of hospitals, its hygienic value.

17. Hygienic requirements to natural illumination of hospital's premises.
18. Hygienic requirements to artificial illumination of hospital's premises. Light sources and types of lamps, its hygienic estimation.
19. Hygienic requirements to water quality in hospitals.
20. Hygienic requirements to water supply of hospitals.
21. Hygienic requirements to maintenance of hospital's premises.
22. Organization and making of disinfection, disinsection and deratization in hospitals.
23. Hygienic aspects of hospital-acquired infections prevention.
24. Hygienic requirements to disposal of hospitals from solid and liquid wastes.
25. Neutralization of solid and liquid wastes.
26. Out-patient-polyclinic organizations, their role in making of medical aid to the population. Functional duties of district physician.
27. Hygienic requirements to choice and lay out of ground area of a polyclinic.
28. Hygienic requirements to internal lay out of polyclinics.
29. Hygienic requirements to sanitary-technical accomplishment and microclimate of polyclinics.
30. Hygienic requirements to furnish, equipment and maintenance of polyclinics.
31. Hygienic requirements to working conditions of medical personnel.
32. Features of doctors' work.
33. Hygiene of work of surgeons, obstetricians-gynecologists, anaesthesiologists, intensive care doctor.
34. Hygiene of work of physicians, physiatrists, infectious doctors.
35. Hygiene of work of roentgenologists and radiologists.
36. State sanitary inspection of hospital and out-patient-polyclinic organizations.
37. Structure of sanitary-epidemiologic service.
38. Centre of hygiene and epidemiology, its structure and functions.
39. Epidemiology department of hygiene and epidemiology centre, its structure, functions. Functional group for supervision of hospitals.
40. Hygiene department of centre of hygiene and epidemiology centre, its structure, functions.
41. Hygienic requirements to hospital ground area.
42. Hygienic requirements to internal lay out of hospital.
43. Hygienic requirements to furnish, equipment of premises of hospitals.

Polymeric building materials.

44. Hygienic requirements to sanitary-technical accomplishment and microclimate of hospitals.
45. Hygienic requirements to maintenance of hospitals.
46. Health services of children and teenagers. Hygiene of children and teenagers as a science, its purpose and tasks.
47. Basic laws of growth and development of children.
48. Physical development of children and teenagers as one of health indicators.
49. Acceleration of physical development of children and teenagers and its socially-hygienic value.
50. Hygienic problems of school maturity.
51. Hygienic principles of lay out and building of preschool institutions and schools. Hygienic requirements to choice, lay out and building of the ground area of preschool institutions and schools.
52. Hygienic requirements to internal lay-out, furnish and equipment of children's preschool institutions.
53. Hygienic requirements to internal lay-out, furnish and equipment of schools.
54. Hygienic requirements to microclimate, sanitary-engineering accomplishment, keeping and cleaning of preschool institutions.
55. Hygienic requirements to microclimate, sanitary-engineering accomplishment, keeping and cleaning of schools.
56. Laws of working capacity of children and teenagers. Regimen of day.
57. Hygienic requirements to organization of teaching and educational process in preschool institutions.
58. Hygienic requirements to organization of teaching and educational process at schools.
59. Hygienic estimation of handwork and industrial training of children and teenagers. Hygienic bases of professional orientation.
60. Hygienic estimation of physical training of children and teenagers.

### **Laboratory Work.**

#### **I. Determine the parameters.**

1. Examine situational plan of hospital.
2. Examine general plan of hospital.
3. Examine working drawings of hospital's reception.
4. Examine working drawings of hospital's therapeutic department.

5. Examine working drawings of hospital's surgical department.
6. Examine working drawings of prevention department of polyclinic.
7. Determine cooling ability of air.
8. Determine equivalent effective temperature.
9. Determine light factor.
10. Determine factor of natural light exposure.
11. Determine angle of light incidence and aperture corner.
12. Determine artificial light exposure by objective and calculation method.
13. Determine ventilation rate.
14. Determine necessary volume of ventilation.
15. Determine efficiency of personnel's hands processing,
16. Determine quality of physical and chemical disinfection,
17. Determine quality of material sterilization.
18. Organize carrying out of current sanitary inspection of hospitals.
19. Develop scheme of sanitary-hygienic inspection of hospital.
20. Determine individual height.
21. Determine individual weight of body.
22. Determine individual thorax circle.
23. Determine individual muscular force of hand.
24. Determine individual vital capacity of lungs.
25. Determine parameters of student's table, chair.
26. Determine chair and table interposition.
27. Study time-table.

**II.** Estimate the received results.

**III.** Offer actions for hospital project, parameters of microclimate, illumination and ventilation improvement; qualitative disinfection, sterilization and hands processing; proper sanitary inspection of hospitals; improvement of parameters of physical development of children and teenagers, student's table, chair, chair, table interposition, time-table.

**IV.** Record the laboratory work report.

#### **The literature.**

1. Lectures № 6-8.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 14-16, 75, 89, 94-142.

**Laboratory classes № 32.****The topic: HYGIENIC ESTIMATION OF NUTRITION  
IN HOT CLIMATE CONDITIONS**

*The theme has great value for further studying of tropical illnesses and in practical work of a doctor.*

**Aim of the Lesson:** to be able to assess rationality and safety of nutrition in hot climate and to propose measures for the improvement and prevention of food poisonings and malnutrition.

**Checking Questions.**

- ✓ 1. Malnutrition and food poisonings, its classification. Heat of hot climate as a risk factor for food poisonings occurrence.
- ✓ 2. Hygienic characteristic of malnutrition of insufficient and superfluous nutrition.
- ✓ 3. Hygienic characteristic of bacterial food poisonings.
- ✓ 4. Hygienic characteristic of not bacterial food poisonings and poisonings of unstated etiology.
- ✓ 5. Sanitary-and-hygienic examination of foodstuffs.
- ✓ 6. Preventive maintenance of malnutrition and food poisonings. Investigation of food poisoning.

**Multiple Choice Questions.****Choose proper answers**

1. The forms of PCM are:
  - 1) kwashiorkor;
  - 2) pellagra;
  - 3) xerophthalmia;
  - 4) beriberi;
  - 5) marasmus;
2. Symptoms of marasmus are:
  - 1) mental changes;
  - 2) severe muscle wasting;
  - 3) severe growth retardation;
  - 4) failure to gain weight;
  - 5) anemia.
3. Classification of food products after examination is:
  - 1) products of high quality;



- 2) products suitable for food without restrictions;
  - 3) products of lowered quality;
  - 4) conditionally suitable products;
  - 5) substandard products.
- 4.** Hygienic examination of food products is:
- 1) studying of documents certifying origin and quality of products;
  - 2) external examination, finding out a condition of container;
  - 3) selectively opening of container and subjecting of products to organoleptic research;
  - 4) performing tests in laboratory;
  - 5) checking of personnel's state of health.
- 5.** Preventive measures of malnutrition in hot climate:
- 1) increase food production by scientific cultivation;
  - 2) fortification of arte (flour) with protein and calcium or milk should be fortified with vitamin A and vitamin D;
  - 3) improvement of environmental sanitation is necessary to prevent the parasitic infections;
  - 4) presence of bacterial air pollution;
  - 5) education of public on fundamentals of diet and nutrition and help from voluntary and international organization.
- 6.** Hygienic rationing is:
- 1) preliminary expert estimation of the presented documents and product samples, definition of order and examination volume, sampling, laboratory researches, registration and the certification about the state hygienic registration of production and it's entering into the State hygienic register of Ministry of Health Service;
  - 2) studying of documents certifying origin and quality of products;
  - 3) ability to satisfy physiological requirements of person and to provide safety for life and harmlessness for people's health of present and future generations;
  - 4) permission, restriction or manufacture and application prohibition, establishment of maximum permissible levels of the maintenance of harmful substances and factors in various objects of environment and quality monitoring;
  - 5) selective opening of containers and sending products to organoleptic research.
- 7.** Hygienic examination stages of foodstuff are:
- 1) studying of documents certifying origin and quality of products;

- 2) permission, restriction or manufacture and application prohibition, establishment of maximum permissible levels of the maintenance of harmful substances and factors in various objects of environment and a quality monitoring;
  - 3) external examination, finding out the condition of container;
  - 4) selective opening containers and sending products to organoleptic research;
  - 5) sending of test for the analysis in laboratory.
- 8. Hygienic regulation is:**
- 1) preliminary expert estimation of the presented documents and product samples, definition of order and examination volume, sampling, laboratory researches, registration and the certification about the state hygienic registration of production and it's entering into the State hygienic register of Ministry of Health Service;
  - 2) research of products on conformity to StSt;
  - 3) ability to satisfy physiological requirements of person and to provide safety for life and harmlessness for people's health of present and future generations;
  - 4) permission, restriction or manufacture and application prohibition, establishment of maximum permissible levels of the maintenance of harmful substances and factors in various objects of environment and quality monitoring;
  - 5) selective opening of containers and sending products to organoleptic research.
- 9. Hygienic registration is:**
- 1) preliminary expert estimation of the presented documents and product samples, definition of order and examination volume, sampling, laboratory researches, registration and the certification about the state hygienic registration of production and it's entering into the State hygienic register of Ministry of Health Service;
  - 2) studying of documents certifying origin and quality of products;
  - 3) ability to satisfy physiological requirements of person and to provide safety for life and harmlessness for people's health of present and future generations;
  - 4) permission, restriction or manufacture and application prohibition, establishment of maximum permissible levels of the maintenance of harmful substances and factors in various objects of environment and quality monitoring;

5) selective opening of containers and sending products to organoleptic research.

**10. Certification is:**

- 1) preliminary expert estimation of the presented documents and product samples, definition of order and examination volume, sampling, laboratory researches, registration and the certification about the state hygienic registration of production and it's entering into the State hygienic register of Ministry of Health Service;
- 2) studying of documents certifying origin and quality of products;
- 3) permission, restriction or manufacture and application prohibition, establishment of maximum permissible levels of the maintenance of harmful substances and factors in various objects of environment and quality monitoring;
- 4) selective opening of containers and sending products to organoleptic research;
- 5) is a research of products on conformity to StSt.

**11. The product, suitable for nutrition without restrictions:**

- 1) meets all requirements of the corresponding standard, harmless to health, has good organoleptic qualities;
- 2) mismatches requirements of the standard or has the defect which essentially is not worsening its organoleptic quality;
- 3) supposes to the use with the condition, that the consumer will be informed on the lowered value;
- 4) has lacks which do its unsuitable for nutrition without preliminary neutralization or improvement of organoleptic properties;
- 5) is characterized by defects which do not suppose its use for nutrition.

**12. The product, suitable for nutrition of the lowered quality:**

- 1) meets all requirements of the corresponding standard, harmless to health, has good organoleptic qualities;
- 2) mismatches requirements of the standard or has the defect which essentially is not worsening its organoleptic quality;
- 3) supposes to the use with the condition, that the consumer will be informed on the lowered value;
- 4) has lacks which do its unsuitable for nutrition without preliminary neutralization or improvement of organoleptic properties;
- 5) is characterized by defects which do not suppose its use for nutrition.

**13. Conditionally suitable product:**

- 1) meets all requirements of the corresponding standard, harmless to health, has good organoleptic qualities;
- 2) mismatches requirements of the standard or has the defect which essentially is not worsening its organoleptic quality;
- 3) supposes to the use with the condition, that the consumer will be informed on the lowered value;
- 4) has lacks which do its unsuitable for nutrition without preliminary neutralization or improvement of organoleptic properties;
- 5) is characterized by defects which do not suppose its use for nutrition.

**14. Substandard product (product of bad quality):**

- 1) meets to all requirements of the corresponding standard, harmless to health, has good organoleptic qualities;
- 2) mismatches requirements of the standard or has the defect which essentially is not worsening its organoleptic quality;
- 3) supposes to the use with the condition, that the consumer will be informed on the lowered value;
- 4) has lacks which do its unsuitable for nutrition without preliminary neutralization or improvement of organoleptic properties;
- 5) is characterized by defects which do not suppose its use for nutrition.

**15. Causes for malnutrition in India are:**

- 1) population growth;
- 2) agriculture and food production;
- 3) prevalence of parasitic and infectious diseases;
- 4) religious and cultural food fads;
- 5) general illiteracy and ignorance.

**Laboratory Work.**

- 1. Determine the content of vitamin C in coniferous extract.
- 2. Estimate the received results.
- 3. Offer actions for improvement.
- 4. Record the laboratory work report.

***Determination of vitamin C content in coniferous extract.***

The method is based on Tilmanse reactive dark blue colouring change under the influence of vitamin C in acidic medium. By quantity of spent Tilmanse reactive we can judge about the contents of vitamin C in researched liquid.

Equipment and reagents: Tilmanse reactive (sodium salt 2,6-dichloro-phenol-endo-phenol), 2% HCl solution, coniferous extract.

Work performance:

- a. 1 ml of 2 % HCl solution is poured into the conical flask;
- b. 1 ml of coniferous extract is added;
- c. 18 ml of distilled water is added;
- d. the solution is titrated with 0.001 N Tilmanse reactive solution till weak-pink colour appearance (which doesn't disappear in 1 min);
- e. the quantity of Tilmanse reactive on 1 titration should not exceed 2 ml;

- f. the content of vitamin C in mg% is calculated under the formula:

$$X = A \times K \times 0.088 \times 100$$

where A - quantity of Tilmanse reactive, used on titration, ml;

K - correction factor on a titre of Tilmanse reactive solution;

0.088 - quantity of ascorbin acid mg (vitamin C) which appropriates to 1 ml 0.001 N Tilmanse reactive solution;

100 - factor for recalculation in %.

#### *Hygienic estimation.*

Coniferous extract is suitable for usage if it contains not less than 40 mg% of vitamin C.

**Solve a problem, estimate the obtained data and request actions for their improvement**

#### **Situational Task.**

A young child, 2 years old has the following symptoms: oedema of face, arms and legs, loss of appetite, light coloured hair. Estimate the child's state of health and offer actions for improvement.

*The algorithm of task's solution:*

Nutrition of the child is not adequate, he has deficiency of proteins and due to this – Kwashiorkor.

It is necessary to improve the individual diet: increase intake of the foodstuff with high-protein content, e.g. meat, milk, fish, nuts, pulses, oil-seeds, eggs. It is necessary to provide nutrition education of his mother.

1. During sanitary examination of meat 2 larvae of trichina in 12 compressed preparations were found. Estimate the quality of meat and offer actions for its improvement.

2. A student, 18 years old, ate 100 g of homemade smoked fish (sevruga) and drunk a cup of tea with a piece of white bread. In a day she felt dizziness, pain in stomach, her pupils became irregularly dilated, eyelids descended, she had speech confusion, frequent pulse, temperature was 35°C. That evening she died. Investigate the food poisoning and offer preventive actions.

3. A student ate stale cake and drunk a cup of coffee for breakfast. In 2 hours he felt pain in stomach, weakness, dizziness and began to vomit. Investigate the food poisoning and offer preventive actions.

4. A worker ate a portion of cottage cheese with sour-cream and drunk a cup of milk for breakfast. In an hour he felt nausea, weakness, headache, his temperature raised. Next day the worker felt himself much better. Investigate the food poisoning and offer preventive actions.

5. A surgeon, 28 years old, height 170 cm, weight 85 kg intakes 100 g of proteins, 100 g of fats and 500 g of carbohydrates per day. Estimate the nutritional state and ration and offer actions for its improvement.

6. A medical student (male), 22 years old, height 180 cm, weight 88 kg intakes 90 g of proteins, 100 g of fats and 650 g of carbohydrates per day. Estimate the nutritional state and ration and offer actions for its improvement.

7. A nurse, 25 years old, height 165cm, weight 75 kg intakes 68 g of proteins (30 g of animal proteins), 90 g of fats and 400 g of carbohydrates. Estimate the nutritional state and ration and offer actions for its improvement.

8. A worker, 30 years old, height 168 cm, weight 83 kg intakes 2 mg of vitamin B<sub>1</sub>, 1.8 mg of vitamin B<sub>2</sub>, 1.5 mg of vitamin B<sub>6</sub>, 2.5 mg of vitamin B<sub>12</sub>, 15 mg of vitamin PP, 70 g of vitamin C, 500 mg of calcium per day. Estimate the vitamin and mineral value and offer actions for its improvement.

9. A nursing mother, 25 years old, intakes 40 mg of vitamin C, 2 mg of vitamin B<sub>12</sub> per day. She mainly follows vegetable diet excluding animal food. Estimate the food value of the nursing mother and offer actions for its improvement.

10. A pedagogical student (female) intakes 700 mg of calcium, 100 mg of phosphorus, 300 mg of magnesium, 65 mg of vitamin C, 1 mg of vitamin B<sub>1</sub>, 1,1 mg of vitamin B<sub>2</sub>, 1,5 mg of vitamin B<sub>6</sub>, 2 mg of vitamin

B12. Estimate the vitamin and mineral value and offer actions for its improvement.

**The literature.**

1. Lecture № 9.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 145-149.

**Laboratory classes № 33.****The topic: HYGIENIC ESTIMATION OF WATER SUPPLY  
IN HOT CLIMATE CONDITIONS**

*The theme has great value for further studying of tropical illnesses and in practical work of a doctor.*

**Aim of the Lesson:** to be able to assess water quality and to propose measures for its improvement.

**Checking Questions.**

- ✓ 1. Hygienic estimation of water sources.
- ✓ 2. Disinfection of water. Water purification.
- ✓ 3. Hygienic estimation of water supply systems.
- ✓ 4. Hygienic norms of water supply. Influence of high temperatures on norms of water usage.
- ✓ 5. Influence of high temperatures on physical, chemical and bacteriological parameters of water and open reservoirs.
- ✓ 6. Methods of studying and estimation of water quality.

**Multiple Choice Questions.****Choose proper answers**

1. Types of water sources in hot climate conditions are:
  - 1) open;
  - 2) underground;
  - 3) rivers;
  - 4) ponds;
  - 5) subground.
2. River water is characterized by:
  - 1) large quantity of the weighed substances;
  - 2) small quantity of the weighed substances;
  - 3) low transparency;
  - 4) high transparency;
  - 5) large microbial insemination.
3. Underground sources of water are:
  - 1) soil water;
  - 2) ground water;
  - 3) rivers;
  - 4) channels;



- 5) interstratal water.
- 4. Features of soil waters:**
- 1) lie down close to an earth's surface;
  - 2) lie between two waterproof lays;
  - 3) lie under the 2nd waterproof lay;
  - 4) water composition is exposed to changes;
  - 5) water has steady physical properties, chemical and microbial content.
- 5. Features of interstratal waters:**
- 1) lie down close to an earth's surface;
  - 2) lie between two waterproof lays;
  - 3) lie under the 2nd waterproof lay;
  - 4) water composition is exposed to changes;
  - 5) water has steady physical properties, chemical and microbic content.
- 6. Water indicators are:**
- 1) organoleptic;
  - 2) chemical;
  - 3) physical;
  - 4) biological;
  - 5) microbiological.
- 7. Systems of water supply in hot climate conditions are:**
- 1) general;
  - 2) centralized;
  - 3) local;
  - 4) decentralized;
  - 5) mixed.
- 8. Methods of improvement of water quality in hot climate conditions are:**
- 1) clearing;
  - 2) disinfecting;
  - 3) desinsecting;
  - 4) deratizing;
  - 5) special methods of processing.
- 9. Methods of water treating are:**
- 1) mechanical;
  - 2) physical;
  - 3) biological;
  - 4) microbiological;
  - 5) chemical.
- 10. Methods of water disinfection are:**
- 1) mechanical;

- 2) physical;
  - 3) biological;
  - 4) microbiological;
  - 5) chemical.
- 11. Deodorization is:**
- 1) removal of extraneous smells and smacks of water;
  - 2) elimination of the dissolved harmful gases;
  - 3) full or partial clearing of water from cationes of calcium and magnesium;
  - 4) removal of salts;
  - 5) iron removal.
- 12. Decontamination is:**
- 1) elimination of the dissolved harmful gases;
  - 2) full or partial clearing of water from cationes of calcium and magnesium;
  - 3) iron removal;
  - 4) removal of radioactive substances;
  - 5) fluorine addition.
- 13. Fluorination is:**
- 1) removal of extraneous smells and smacks of water;
  - 2) elimination of the dissolved harmful gases;
  - 3) removal of salts;
  - 4) iron removal;
  - 5) fluorine addition.
- 14. The amount of water needed by each person per day in hot climate conditions is:**
- 1) 14-16 litres in hospitals;
  - 2) 40-60 litres in hospitals;
  - 3) 130 litres in feeding centres;
  - 4) 15-20 litres for personal needs;
  - 5) 30 litres in feeding centres.
- 15. Water sources in hot climate conditions should be protected by the following measures:**
- 1) people should wash in the water source;
  - 2) a fence or wall should be erected to keep animals away;
  - 3) drainage ditches should be dug uphill from an open well to prevent storm water flowing into it;
  - 4) children should play in or around a source;

- 5) latrines should not be located uphill from or within 30 metres of a water source.

### **Laboratory Work.**

- 1. Perform water purification by coagulation (determination of carbonate water hardness, coagulant dose, checking of correctness of measurement of the coagulant dose) and determine content of active chlorine in chlorinated lime.
- 2. Estimate the received results.
- 3. Offer actions for improvement.
- 4. Record the laboratory work report.

#### ***Checking of correctness of measurement of the coagulant dose and performing of water coagulation.***

##### ***Water purification by coagulation:***

Equipment and reagents: 1% solution of aluminium sulfate, 0.1n solution of hydrochloric acid, 0.1% solution of methyl-orange.

##### ***Determination of the carbonate water hardness:***

- a. 100 ml of the investigated water is poured into the conical flask;
- b. 2-3 drops of methyl-orange is added;
- c. the received solution is titrated with 0.1n HCl solution till the changes of yellow color to pink one. The quantity of HCl spent on titration is equal to the carbonate water hardness (mg-eq/dm<sup>3</sup>).

##### ***Determination of the coagulant dose:***

- a. the coagulant dose is found out using the following table:

<b>Carbonate water hardness (mg-eq/dm<sup>3</sup>)</b>	1	2	3	4	5	6	7	8	9	10
<b>Quantity of 1% aluminium sulfate needed for 200 ml of water</b>	2.3	4.5	6.8	9.0	11.3	13.6	15.9	18.0	20.3	23.0

#### ***Checking of the correctness of measurement of the coagulant dose:***

- a. 200 ml of water is poured into each of 3 glasses;
- b. 1% aluminium sulfate is added into the 1<sup>st</sup> glass – the found dose, into the 2<sup>nd</sup> glass – the found dose + 1ml, into the 3<sup>rd</sup> glass – the found dose + 2 ml;
- c. each of the received solutions is mixed one time;
- d. the solution produced the maximum quantity of flakes in 10 minutes is found out;

e. the needed quantity of coagulant for 1 liter of the water is calculated.

***Determination of the content of active chlorine in chlorinated lime:***

- a. 50 ml of distilled water is poured into the conical flask;
- b. 1 ml of 1% chlorinated lime, 2 ml of 25% HCl solution and 5 ml of 5% potassium iodide solution are added and mixed;
- c. the received solution is titrated with 0.7% hyposulphite solution till yellow colour appearance;
- d. a few drops of 0.5% starch solution is added and titrated till the colour disappearance;
- e. the content of active chlorine in the chlorinated lime is calculated under the formula:

$$X = h \times 10$$

where X – the content of active chlorine, %;

h - the quantity of spent 0.7% hyposulphite solution.

***Hygienic estimation.***

The chlorinated lime is suitable for usage if it contains not less than 25% of active chlorine.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

Potable water contents 650 mg/dm<sup>3</sup> of chlorides, 480 mg/dm<sup>3</sup> of sulfates. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

***The algorithm of task's solution:***

Potable water does not correspond to the hygienic requirements. Chlorides and sulfates concentrations are high than MPC (MPC are 350 and 500 mg/dm<sup>3</sup> accordingly).

It is necessary to reveal the source of water pollution and to plan actions on protection of water resources such as planning - zones of sanitary protection, technological - manufacture without dross, application of less toxic products, sanitary and technical - clearing constructions, organizational - dumps at various time of day, legislative - laws on protection. It is

used not only for superficial waters, but also for protection of internal filtration layers of ground.

**1.** Potable water contents 3 mg/dm<sup>3</sup> of fluorine, 400 mg/dm<sup>3</sup> of chlorides, 550 mg/dm<sup>3</sup> of sulphates. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**2.** In potable water microbe number is 100, coli-index is 4, taste is 3 points, smell is 3 points. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**3.** Potable water has 3 points smell, 4 points taste, 15 mg-ekv/dm<sup>3</sup> of general rigidity, 80 mg/dm<sup>3</sup> of nitrates, 450 microbe number, 15 coli-index. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**4.** Potable water has 3 points smell, 3 points taste, 16 mg-ekv/dm<sup>3</sup> of general rigidity, 50 mg/dm<sup>3</sup> of nitrates, 300 microbe number, 10 coli-index. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**5.** Potable water has 4 points smell, 3 points taste, 7 mg-ekv/dm<sup>3</sup> of general rigidity, 40 mg/dm<sup>3</sup> of nitrates, 350 microbe number, 12 coli-index. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**6.** Potable water has 2 points smell, 3 points taste, 10 mg-ekv/dm<sup>3</sup> of general rigidity, 60 mg/dm<sup>3</sup> of nitrates, 450 microbe number, 20 coli-index. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**7.** In potable water 300 mg/dm<sup>3</sup> of chlorides, 450 mg/dm<sup>3</sup> of sulphates, 0,5 mg/dm<sup>3</sup> of fluorine are revealed. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**8.** In water potable 350 mg/dm<sup>3</sup> of chlorides, 500 mg/dm<sup>3</sup> of sulphates, 1,8 mg/dm<sup>3</sup> of fluorine, 12 mg-ekv/dm<sup>3</sup> of rigidity are revealed. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**9.** Well water has 3 points smell, 3 points taste, 14 mg-ekv/dm<sup>3</sup> of general rigidity, 50 mg/dm<sup>3</sup> of nitrates, 0,006 mg/dm<sup>3</sup> of nitrites. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**10.** Water potable has 3 points smell, 3 points taste, 30° of chromaticity, 8 mg-ekv/dm<sup>3</sup> of general rigidity, 4 mg/dm<sup>3</sup> of iron content, 0,7

**Laboratory classes № 33**      **Hygienic estimation of water supply in hot climate conditions**  
mg/dm<sup>3</sup> of active chlorine. Estimate the potable water quality and offer actions for its improvement and protection from pollution.

**The literature.**

1. Lecture № 9.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 149-151.

**Laboratory classes № 34.****The topic: HYGIENE OF WORK IN HOT CLIMATE CONDITIONS**

*The theme has great value for further studying of tropical illnesses and in practical work of a doctor.*

**Aim of the Lesson:** to be able to assess working conditions and to propose measures for its improvement, protection of health and prevention of sick rate.

**Checking Questions.**

- ✓ 1. Influence of work on human organism in hot climate conditions. Microclimate of industrial environment, its hygienic value.
- ✓ 2. Influence of psychophysiological and biological factors of industrial environment on workers in hot climate conditions.
- ✓ 3. Influence of physical and chemical factors of industrial environment on workers in hot climate conditions.
- ✓ 4. Hygiene of agricultural work in hot climate conditions. Hygiene of work in mining, building and light industry.
- ✓ 5. Prevention of professional diseases and poisonings in hot climate conditions.
- ✓ 6. Methods of studying and estimation of working conditions in hot climate.

**Multiple Choice Questions.****Choose proper answers**

1. Heat illness are:
  - 1) heat exhaustion;
  - 2) acclimatization;
  - 3) heat stroke;
  - 4) heat cramps;
  - 5) heat spasm.
2. Symptoms of heat exhaustion are:
  - 1) vague;
  - 2) weakness;
  - 3) dizziness;
  - 4) stomachache;
  - 5) nausea.
3. Heat exhaustion:

- 1) is non–life threatening clinical syndrome of weakness, malaise, nausea, syncope, and other nonspecific symptoms caused by heat exposure;
  - 2) can occur in physically fit people who sweat profusely and replace lost water but not salt, thereby causing hyposodiumemia;
  - 3) is caused by water and electrolyte imbalance due to heat exposure, with or without exertion;
  - 4) is hyperthermia accompanied by a systemic inflammatory response causing multiple organ dysfunction and often death;
  - 5) includes such symptoms as temperature more 40<sup>0</sup>C and altered mental status, often absence of sweating.
- 4. Heat cramps:**
- 1) is non–life threatening clinical syndrome of weakness, malaise, nausea, syncope, and other nonspecific symptoms caused by heat exposure;
  - 2) can occur in physically fit people who sweat profusely and replace lost water but not salt, thereby causing hyposodiumemia;
  - 3) is caused by water and electrolyte imbalance due to heat exposure, with or without exertion;
  - 4) is hyperthermia accompanied by a systemic inflammatory response causing multiple organ dysfunction and often death;
  - 5) includes such symptoms as temperature more 40<sup>0</sup>C and altered mental status, often absence of sweating.
- 5. Heatstroke:**
- 1) is non–life threatening clinical syndrome of weakness, malaise, nausea, syncope, and other nonspecific symptoms caused by heat exposure;
  - 2) can occur in physically fit people who sweat profusely and replace lost water but not salt, thereby causing hyposodiumemia;
  - 3) is caused by water and electrolyte imbalance due to heat exposure, with or without exertion;
  - 4) is hyperthermia accompanied by a systemic inflammatory response causing multiple organ dysfunction and often death;
  - 5) includes such symptoms as temperature more 40<sup>0</sup>C and altered mental status, often absence of sweating.
- 6. Prevention actions of adverse influence of heat microclimate are:**
- 1) working out of a rational mode of work and rest;
  - 2) organization of a drinking mode;
  - 3) air conditioning;
  - 4) arrangement of premises for rest;
  - 5) individual protection equipments (overalls, helmets, points, masks).



7. Populated area with hot climate must be provided with:
  - 1) airing;
  - 2) insolation;
  - 3) orientations of streets and buildings taking into account dominating wind direction;
  - 4) optimum working conditions;
  - 5) internal planning of inhabited, public and industrial building.
8. Acclimatisation is:
  - 1) functional readiness of pupils organism to regular training at school;
  - 2) gradual physiological adaptation that improves an individual's ability to tolerate heat stress;
  - 3) presence of such symptoms as temperature more 40<sup>0</sup>C and altered mental status, often absence of sweating;
  - 4) non–lifethreatening clinical syndrome of weakness, malaise, nausea, syncope, and other nonspecific symptoms caused by heat exposure;
  - 5) studying of documents certifying an origin and quality of products.
9. Agricultural work features in countries with hot climate is characterized by:
  - 1) heat and intensive solar radiation;
  - 2) intellectual loadings;
  - 3) soil dust and chemical substances applied as fertilizers or means of pest control of agricultural production;
  - 4) compelled pose;
  - 5) professional overstress of vocal apparatus.
10. Widespread diseases in field of husbandry are:
  - 1) rhinitis, pharyngitis, tracheitis, chronic bronchitis;
  - 2) asthenopia, accommodation spasm;
  - 3) diseases of peripheral nervous system and locomotorium;
  - 4) chronic arthritises, lordosis, scoliosis;
  - 5) pustulous diseases of skin, conjunctivitis.
11. Managing of heat stress is:
  - 1) controlling the temperature;
  - 2) providing mechanical aids where possible to reduce the work rate;
  - 3) preventing of dehydration;
  - 4) analysis in a laboratory;
  - 5) providing of training.
12. The risks of heat stress can be managed by:
  - 1) providing training;
  - 2) controlling the temperature;

- 3) providing mechanical aids;
  - 4) preventing dehydration;
  - 5) regulating exposure.
- 13.** Combination of production factors can be:
- 1) heat and high or low humidity;
  - 2) heat and absence of air movement (at inefficient ventilation);
  - 3) adverse meteorological factors plus various harmful chemical compounds in a working zone;
  - 4) weak light exposure of workplaces with intensive noise;
  - 5) dust content or other physical and mechanical factors.
- 14.** Action of production factors on a worker's organism can be:
- 1) general or local;
  - 2) constant or time;
  - 3) during all labour shift or periodically within days;
  - 4) acute and chronic;
  - 5) mixed or combined.
- 15.** Prevalent professional illnesses structure in conditions of hot climate are:
- 1) vibrating illness;
  - 2) industrial traumatism;
  - 3) pustulous diseases of a skin;
  - 4) professional pneumoconiosis (silicosis);
  - 5) professional neuritis.

### **Laboratory Work.**

- 1. Define the contents of carbonic monoxide, benzene, chlorine in air of a working zone.
- 2. Estimate the received results.
- 3. Offer actions for improvement.
- 4. Record the laboratory work report.

#### ***Determination of carbonic monoxide by express method.***

Equipment: the device for definition of carbonic monoxide (figure 33) in air by express method.

Work performance:

- a. it is necessary to compare colour of the indicator substance with the standard scale (should correspond to "0" standard) before using of the indicator tube;
- b. the indicator tube is opened and held in the hand to heat up it to 35-

- 36°C;
- c. the rubber bulb of the device is compressed;
  - d. the indicator tube is connected to the device and air is passed;
  - e. if during 30 sec there was no colour change of the indicator, air is passed during 2 min to full release of the rubber bulb;
  - f. the indicator tube is disconnected and closed by the cover;
  - g. colour of the indicator is compared with the scale of the constant standard in 10 min.



**Figure 33.** Device for definition of carbonic monoxide.

*Hygienic estimation.*

The maximum permissible concentration of carbon monoxide is 20 mg/m<sup>3</sup> in air of a working zone of industrial enterprises.

***Determination of contents of benzene and chlorine in air of a working zone by express method.***

Equipment: gas analyzer UG-1, indicator tubes, standard scales.

Work performance:

- a. bellows is compressed by the rod;
- b. the indicator tube is connected to the rubber tube (preliminary it is necessary to brake off the sealed ends);
- c. the stopper is removed from the safety catch and air is passed through the indicator tube;

d. the indicator tube is taken out and put to the scale: the top limit of color column shows on the scale concentration of the defined substance in  $\text{mg}/\text{dm}^3$ .

*Hygienic estimation.*

The maximum permissible concentration of petrol is 100, chlorine is  $1 \text{ mg}/\text{m}^3$  in air of a working zone of industrial enterprises.

**Solve a problem, estimate the obtained data and request actions for their improvement**

**Situational Task.**

The industrial enterprise (1<sup>st</sup> class) is situated in 100 meters from inhabited area. Total area of the enterprise includes 80% of buildings, 5% of green plantings. Volume of the premise per one worker is  $5 \text{ m}^3$ , square of the premise per one worker is  $2.5 \text{ m}^2$ . Wardrobes and washing-up rooms are included as sanitary premises. Personal hygiene rooms for women are not organized. Water supply is centralized. Purification of production premises from liquid wastes is performed via canalization system, solid wastes are not gathered. Estimate the planning, development and maintenance of the industrial enterprise and offer actions for its improvement.

*The algorithm of task's solution:*

The lay-out, building and content of the industrial enterprise mismatches hygienic requirements: sanitary-protective zone for the enterprise is less than normal (normal is 1000 m), building area is overestimated (normal is 65 %), gardening area is underestimated (normal is 15 %), volume and area of premises per one worker are reduced (normal are  $15 \text{ m}^3$  and  $4,5 \text{ m}^2$  accordingly), shower, rooms of personal hygiene of woman, health centers, inhalator room, premises for drying, clearings and neutralization of overalls and footwear are not organized. There is no hot water in industrial, auxiliary and sanitary-household premises, firm garbage is not gathered.

It is necessary to increase the sanitary-protective zone, gardening area, volume and area of premises per one worker, to reduce building area, in addition to design shower, rooms of personal hygiene of woman, health centers, inhalator room, premises for drying, clearings and neutralizations of overalls and footwear, to spend distributing of hot water to industrial,

auxiliary and sanitary-household premises, to collect firm garbage in metal, hermetically closed garbage's containers, placed on cement platforms.

**1.** The projected factory (5<sup>th</sup> class) is situated in inhabited area. Protective zone (30 m) is planed and serves as park. Level of standing of subsoil waters is 1 m. Territory site includes 65% of buildings and 10% of green plantings. Volume of the premise per one worker is 12 m<sup>3</sup>, square of the premise per one worker is 3.8 m<sup>2</sup>. Wardrobes and first-aid posts are included as sanitary premises. Estimate the planning, development and maintenance of the industrial enterprise and offer actions for its improvement.

**2.** The projected paper plant (4<sup>th</sup> class) is situated in suburban area. Protective zone (100 m) is planed. Medical-sanitary unit, garage and nursery are inside the protective zone. Level of standing of subsoil waters is 0.5 m. Territory site includes 50% of buildings and 7% of green plantings. Volume of the premise per one worker is 15 m<sup>3</sup>, square of the premise per one worker is 4.5 m<sup>2</sup>. Sectors with high heat-production are located near inner walls on the second floor of three-stored building. Wardrobes and washing-up rooms are included as sanitary premises. Water supply is centralized, canalization is provided. Estimate the planning, development and maintenance of the industrial enterprise and offer actions for its improvement.

**3.** In the reactor workshop temperature is 28°C (warm period of year), humidity is 70%, air movement rate is 0.4 m/s. Thermal radiation of worker is 50 Wt/m<sup>2</sup>. Estimate the microclimate and offer actions for its improvement.

**4.** In the assembly workshop noise level is 74 dB (frequency – 8000 Hz), content of asbestos dust is 3 mg/m<sup>3</sup>. Estimate the physical factors in the workshop and offer actions for its improvement.

**5.** In the pressing workshop equivalent noise level is 105 dB, content of talcum dust is 5 mg/m<sup>3</sup>. Estimate the physical factors and dust in the workshop and offer actions for its improvement.

**6.** In the textile workshop equivalent noise level is 115 dB, content of dust with 2% SiO<sub>2</sub> admixture is 6 mg/m<sup>3</sup>, content of asbestos dust is 6 mg/m<sup>3</sup>, content of talcum dust is 7 mg/m<sup>3</sup>. Estimate the physical factors and dust in the workshop and offer actions for its improvement.

**7.** In air of the reactor workshop 30 mg/m<sup>3</sup> of ammonia and 1.5 mg/m<sup>3</sup> of chlorine were found. Estimate the air of the workshop and offer actions for its improvement.

**8.** In air of the mechanic workshop  $38 \text{ mg/m}^3$  of chlorine and  $10 \text{ mg/m}^3$  of benzol were found. Estimate the air of the workshop and offer actions for its improvement.

**9.** In the model workshop temperature is  $17^\circ\text{C}$  (cold period of year), humidity is 45%, air movement rate is 0.2 m/s. Thermal radiation of worker is  $70 \text{ Wt/m}^2$ . Estimate the microclimate and offer actions for its improvement.

**10.** In the assembly workshop where high accuracy work is performed natural illumination factor is 1%, illumination with luminescent lamps is 250 lx. Estimate the illumination of the workshop and offer actions for its improvement.

### **The literature.**

1. Lecture № 9.
2. Hygiene: Tutorial / N.I. Miklis, S.I. Korikova, I.I. Burak. – Vitebsk: VSMU, 2012. – P. 142-415, 152-154.

**Laboratory classes № 35.****The topic: FINAL CONTROL STUDY OF CLASSES OF HYGIENE OF HOT CLIMATE**

*The theme has important value for further training at department of organization of public health services and public health, therapy department, studying of tropical illnesses and in practical work of a doctor.*

**Aim of the Lesson:** to be able to assess rationality and safety of nutrition, water quality, working conditions in hot climate conditions and to propose actions for its rationalization.

**Checking Questions.**

1. Features of nutrition in hot climate conditions.
2. Malnutrition in hot climate conditions and their prevention.
3. Food poisonings in hot climate conditions, their classification.
4. Heats as risk factor for food poisonings occurrence.
5. Hygienic characteristic of food poisonings of bacterial nature.
6. Hygienic characteristic of food poisonings of not bacterial nature.
7. Sanitary-hygienic examination of foodstuffs in conditions of hot climate.
8. Hygienic estimation of water sources in conditions of hot climate.
9. Hygienic estimation of water treatment methods.
10. Hygienic estimation of water supply systems in hot climate conditions.
11. Hygienic norms of water supply. Influence of high temperatures on norms of water usage.
12. Hygienic requirements to water quality in hot climate conditions.
13. Heats influence on organoleptic, chemical and bacteriological indicators of water.
14. Influence of work on human organism in hot climate conditions. Microclimate of industrial environment, hygienic value.
15. Influence of psychophysiological and biological factors of industrial environment on workers in hot climate conditions.
16. Influence of physical and chemical factors of industrial environment on workers in hot climate conditions.
17. Hygiene of agricultural work in hot climate conditions.
18. Hygiene of work in mining, building and light industry.
19. Prevention of professional diseases and poisonings in hot climate conditions.

### **Laboratory Work.**

#### **I. Determine the parameters.**

1. Check the correctness of measurement of the coagulant dose and perform coagulation of 10 liters of water.
2. Determine content of active chlorine in chlorinated lime.
3. Determine content of vitamin C in coniferous extract.
4. Determine contents of carbonic monoxide in air of working zone.
5. Determine contents of benzene, chlorine in air of working zone.

#### **II. Estimate the received results.**

**III.** Offer actions for water treatment optimization; improvement of nutrition in conditions of hot climate; prevention of harmful influence of carbonic monoxide, benzene, chlorine in a working zone.

#### **IV.** Record the laboratory work report.

### **The literature.**

1. Lectures № 9.
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**Laboratory classes on hygiene**

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