

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ОБЩЕЙ ГИГИЕНЫ

**СИТУАЦИОННЫЕ ЗАДАЧИ
ПО ОБЩЕЙ ГИГИЕНЕ**

**SITUATIONAL CASE TASKS
OF GENERAL HYGIENE**

Сборник задач



Минск БГМУ 2022

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Представлены ситуационные задачи по основным темам дисциплины «Общая гигиена» для проведения практических и итоговых занятий (коллоквиумов).

Предназначается для самостоятельной работы студентов 2–3-го курсов медицинского факультета иностранных учащихся, изучающих общую гигиену на английском языке.

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ENVIRONMENTAL HYGIENE

DRINKING WATER

Task 1

The water sample was taken from an artesian well, 100 m from a livestock farm (central water supply system). The depth of the well is 50 m. The water disinfection system hasn't been functioning recently.

Water analysis results:

- chromaticity, degrees — 40, yellowish color;
- transparency, cm — 25;
- smell at 20 °C, points — 3, musty;
- taste at 20 °C, points — 3, marsh;
- the sediment is noticeable, in the form of brown flakes;
- ammonia by nitrogen, mg/l — 0.4;
- nitrite ion, mg/l — 0.8;
- nitrates, mg/l — 60;
- sulphates, mg/l — 250;
- chlorides, mg/l — 120;
- iron, mg/l — 1.6;
- fluorides, mg/l — 0.2;
- permanganate oxidability, mg O₂/l — 10;
- total microbial number, CFU/ml — 1600;
- coli-form microorganisms, CFU/l — 50.

Evaluate each parameter according to the standard value. Make a conclusion about the suitability of water for drinking purposes. What laboratory indicators suggest about water pollution with organic substances?

Task 2

The water sample was taken from the tap (central water supply system).

Water analysis results:

- chromaticity, degrees — 10;
- transparency, cm — 20;
- smell at 20 °C, points — 1;
- taste at 20 °C, points — 1;
- the sediment — insignificant;
- ammonia by nitrogen, mg/l — 1;
- nitrite ion, mg/l — 2;
- nitrates, mg/l — 57;
- sulphates, mg/l — 30;
- chlorides, mg/l — 25;

- iron, mg/l — 1.0;
- fluorides, mg/l — 0.4;
- permanganate oxidability, mg O₂/l — 3;
- total hardness, mg-equiv/l — 4;
- total microbial number, CFU/ml — 100;
- coli-form microorganisms, CFU/l — 1.
- residual chlorine (free), mg/l — 0.1

Make a conclusion about the suitability of water for drinking purposes.

Task 3

Analysis of water sample from draw-well. The depth of the well is 12 m, the shaft protrudes above the ground to a height of 100 cm, covered.

Water analysis results:

- chromaticity, degrees — 20;
- smell at 20 °C, points — 4;
- taste at 20 °C, points — 4;
- turbidity, mg/l — 5;
- nitrates, mg/l — 35;
- sulphates, mg/l — 350;
- chlorides, mg/l — 90;
- total hardness, mg-equiv/l — 8;
- permanganate oxidability, mg O₂/l — 9;
- total microbial number, CFU/ml — 300;
- coli-form microorganisms, CFU/l — 5.

Make a conclusion about the suitability of water for drinking purposes.

Task 4

Analysis of water sample from draw-well. The shaft well is 4 m deep, has a wooden frame; located at a distance of 5 m from the barn for livestock; not covered.

Water analysis results:

- chromaticity, degrees — 14, yellowish color;
- smell at 20 °C, points — 0;
- taste at 20 °C, points — 4, ferruginous;
- transparency, cm — 20;
- the sediment — insignificant;
- nitrates, mg/l — 20;
- sulphates, mg/l — 25;
- chlorides, mg/l — 40;
- total hardness, mg-equiv/l — 6;
- permanganate oxidability, mg O₂/l — 4;
- total microbial number, CFU/ml — 50;

- coli-form microorganisms, CFU/1 — 0.

Make a conclusion about the suitability of water for drinking purposes.

Task 5

In an urban-type settlement, water supply source is a lake located 3 km away (central water supply system). There is a chemical factory near the settlement. Improvement of water quality is carried out by sedimentation, filtration and normal doses chlorination methods.

Recently, residents of the settlement have noted the deterioration of the organoleptic properties of water and the appearance of a chlorophenol smell in it.

Water analysis results:

- chromaticity, degrees — 25;
- transparency, cm — 25;
- smell at 20°C, points — 4;
- taste at 20°C, points — 3;
- ammonia by nitrogen, mg/1 — 1.2;
- nitrite ion, mg/1 — 0,2;
- nitrates, mg/1 — 50;
- sulphates, mg/1 — 100;
- chlorides, mg/1 — 80;
- permanganate oxidability, mg O₂/1 — 8;
- phenols, mg/1 — 0,01;
- total microbial number, CFU/ml — 400;
- coli-form microorganisms, CFU/1 — 45.
- residual chlorine (free), mg/1 — 0.1

Make a conclusion about the suitability of water for drinking purposes.

Task 6

Analysis of water sample from draw-well:

- chromaticity, degrees — 15;
- smell at 20 °C, points — 2;
- taste at 20 °C, points — 3;
- transparency, cm — 30;
- nitrates, mg/1 — 50;
- sulphates, mg/1 — 800;
- chlorides, mg/1 — 400;
- total hardness, mg-equiv/1 — 5;
- permanganate oxidability, mg O₂/1 — 8;
- total microbial number, CFU/ml — 250;
- coli-form microorganisms, CFU/1 — 10.

Make a conclusion about the suitability of water for drinking purposes.

HYGIENE OF RESIDENTIAL AND PUBLIC BUILDINGS

MICROCLIMATE

Task 1

Indications of dry and wet bulbs of aspirating August psychrometer in the classroom are +23 °C and +17 °C respectively. Atmospheric pressure is 738 mm Hg.

Determine the relative humidity (according to the formula and table), saturation deficiency, assess them. What is the dew point temperature?

Perform hygienic assessment of calculated data (compare the result with the hygienic standard).

Task 2

Indications of dry and wet bulbs of aspirating August psychrometer in the living room are +21 °C and +19 °C respectively. Atmospheric pressure is 760 mm Hg.

Determine the relative humidity (according to the formula and table), saturation deficiency, assess them. What is the dew point temperature?

Perform hygienic assessment of calculated data (compare the result with the hygienic standard).

Task 3

The speed of the air movement in the living room was determined using a kata thermometer. The factor of the cylindrical kata thermometer equal 520 Mcal/cm², cooling time is 105 seconds. In the classroom the temperature is +19 °C.

Find the cooling capacity of the air (H), air movement speed.

Perform hygienic assessment of calculated data (compare the result with the hygienic standard).

Task 4

In the living room the temperature of dry thermometer is +20 °C, the temperature of wet thermometer is +15 °C (measured by means of an August stationary psychrometer). Air movement speed — 0.3 m/s.

Find the effective temperature (ET). Perform hygienic assessment of calculated data (compare the result with the hygienic standard). If the effective temperature is not included in the line comfort, show how to modify the parameters of the microclimate that ET went into it.

Task 5

In the classroom the temperature of dry thermometer is +21 °C, the temperature of wet thermometer is +18 °C (measured by means of an August stationary psychrometer). The factor of the cylindrical kata thermometer equal 558 Mcal/cm², cooling time is 86 seconds.

Task: calculate the cooling capacity of the air (H), air movement speed and effective temperature (ET). Perform hygienic assessment of calculated data (compare the result with the hygienic standard). If the effective temperature is not included in the line comfort, show how to modify the parameters of the microclimate that ET went into it.

Task 6

In the living room the temperature of dry thermometer is +18 °C, the temperature of wet thermometer is +13 °C (measured by means of an August stationary psychrometer). The factor of the cylindrical kata thermometer equal 546 Mcal/cm², cooling time is 68 seconds.

Task: calculate the cooling capacity of the air (H), air movement speed and effective temperature (ET). Perform hygienic assessment of calculated data (compare the result with the hygienic standard). If the effective temperature is not included in the line comfort, show how to modify the parameters of the microclimate that ET went into it.

Task 7

Perform a hygienic assessment of the air state in the classroom of the department before the start of classes and at the end of the working day according to the data given in the table.

| Investigated indicators | Before the start of classes | At the end of the working day |
|-----------------------------|-----------------------------|-------------------------------|
| CO ₂ content, ‰ | 0.5 | 1.9 |
| Air temperature, °C | 18.3 | 22.2 |
| Relative humidity, % | 61 | 78 |
| Cooling capacity of the air | 5.4 | 4.1 |

Task 8

Perform a hygienic assessment of the air state in the classroom of the department before the start of classes and at the end of the working day according to the data given in the table.

| Investigated indicators | Before the start of classes | At the end of the working day |
|-----------------------------|-----------------------------|-------------------------------|
| CO ₂ content, ‰ | 0.6 | 1.4 |
| Air temperature, °C | 16.5 | 21.4 |
| Relative humidity, % | 45 | 60 |
| Cooling capacity of the air | 4.5 | 5.6 |

Task 9

The parameters of microclimate in two closed rooms are: in the first — the air temperature is 23 °C, and the relative humidity — 63 %, in the second — 15 °C and 82 %, respectively. In which of the rooms is the value of physical saturation deficiency higher?

Task 10

The parameters of microclimate in two closed rooms are: in the first — the air temperature is 18 °C, and the relative humidity — 52 %, in the second — 28 °C and 69 %, respectively. In which of the rooms is the value of physical saturation deficiency higher?

Task 11

The frequency of wind direction in the region in one year is:

- Northwest wind — 37 days;
- North wind — 34 days;
- Northeast wind — 30 days;
- East wind — 29 days;
- Southeast wind — 37 days;
- Southern wind — 50 days;
- Southwest wind — 67 days;
- Western wind — 71 days;
- Calm — 11 days.

Draw a wind rose. Indicate optimal location for oil refineries.

Task 12

The frequency of wind direction in the region in 5 years is:

- Northwest wind — 19 %;
- North wind — 9 %;
- Northeast wind — 8 %;
- East wind — 11 %;
- Southeast wind — 31 %;
- Southern wind — 6 %;
- Southwest wind — 5 %;
- Western wind — 6 %;
- Calm — 5 %.

Draw a wind rose. Indicate optimal location for chemical factory.

LIGHTING

Task 1

On a workplace in a university laboratory natural illumination was 360 lux. Lighting outdoor was 16 300 lux. What was the coefficient of natural light? Compare the result with the hygienic standard.

Task 2

In the morning at the student's workplace in the classroom combined illumination was 320 lux, half of which is artificial light. Lighting outdoor was 15500 lux. What was the coefficient of natural light? Compare the result with the hygienic standard.

Task 3

Depth of the classroom — 7.5 m, length — 5.5 m, height — 3 m. The room has two windows, their height is 2.6 m above the floor, a glazed area of each of them 2.6 m². Calculate the light coefficient, coefficient of depth. Compare the result with the hygienic standard.

Task 4

Depth of the university laboratory — 9 m, length — 4.3 m, height — 3.3 m. The room has five windows, their height is 2.9 m above the floor, a glazed area of each of them 3.1 m². Calculate the light coefficient, coefficient of depth. Compare the result with the hygienic standard.

Task 5

Depth of the living room — 4.5 m, length — 3.1 m, height — 3 m. The room has two windows, their height is 2.7 m above the floor, a glazed area of each of them 2.4 m². Internal natural lighting is 200 lux, lighting outdoor — 8200 lux. Calculate the coefficient of natural light, the light coefficient, coefficient of depth. Compare the result with the hygienic standard.

Task 6

Center of workplace is 3.6 m from the window. The height of the upper edge of the glazing windows from the horizontal plane workplace 1.8 m. 7.5 m from the window there is a nearby building that rises above 7.3 m from the horizontal plane of workplace. Calculate the light angle on the workplace and the angle of the aperture (with picture). Compare the result with the hygienic standard.

Task 7

Center of workplace is 3 m from the window. The height of the upper edge of the glazing windows from the horizontal plane workplace 1.9 m. 12 m from the window there is a nearby building that rises above 6 m from the horizontal plane of workplace. Calculate the light angle on the workplace and the angle of the aperture (with picture). Compare the result with the hygienic standard.

Task 8

Area of room in a hostel is 18 m², illuminated by 2 incandescent lamps of 150 watts each. Et is 29. Calculate the value of artificial light using the method of «Watt», compare it with the hygienic standards for the living room.

Task 9

Area of room in a hostel is 12 m², illuminated by 2 incandescent lamps of 100 watts each, light — reflected. Calculate the value of artificial light using the method of «Watt», compare it with the hygienic standards for the living room.

Task 10

Reading hall area of 170 m² illuminated by 34 luminescent lamps of 40 watt each. Calculate the value of illumination in lux. Compare the result with the hygienic standard.

Task 11

Classroom of 64 m² illuminated by 10 luminescent lamps of 45 watt each. Calculate the value of illumination in lux. Compare the result with the hygienic standard.

Task 12

Choose the best lighting option for the classroom of 52 m² (based on a comparing with hygienic standards):

- 8 incandescent lamps of 100 watts each, light — reflected;
- 44 luminescent lamps of 40 watt each;
- 36 luminescent lamps of 50 watt each.

Task 13

Choose the best lighting option for the living room of 24 m² (based on a comparing with hygienic standards):

- 4 luminescent lamps of 40 watt each;
- 4 incandescent lamps of 150 watts each, light — reflected;
- 3 luminescent lamps of 50 watt each.

VENTILATION

Task 1

Calculate the ventilation volume, frequency rate of air exchange in 1 hour for the living room of 45 m^3 , which is home to 3 people. The concentration of CO_2 in the moment of research was 1.4 ‰. Calculate the ventilation volume, frequency rate of air exchange in 1 hour. Compare the result with the hygienic standard. Make a hygienic assessment of the effectiveness of ventilation and air exchange rate.

Task 2

Calculate the ventilation volume, frequency rate of air exchange in 1 hour for the living room of $5.5 \times 3.9 \times 2.8 \text{ m}$, which is home to 4 people. The concentration of CO_2 in the moment of research was 0.19 ‰. Compare the result with the hygienic standard. Make a hygienic assessment of the effectiveness of ventilation and air exchange rate.

Task 3

80 people are engaged in an auditorium of $8 \times 15 \times 5 \text{ m}$. The auditorium is equipped with supply and exhaust ventilation. Determine how much air should be supplied to the audience within an hour? What will be the frequency rate of air exchange in 1 hour?

Task 4

There are 4 people in the living room of 62 m^3 volume. Ventilation is realized by opening the window for 10 minutes every hour. Area of the window opening — 0.15 m^2 , air speed — 1 m/s . Calculate the ventilation volume, frequency rate of air exchange in 1 hour. Compare the result with the hygienic standard. Make a hygienic assessment of the effectiveness of ventilation and air exchange rate.

Task 5

There are 3 people in the room of $5 \times 3 \times 3 \text{ m}$. Ventilation of the room is realized by opening the window for 15 minutes every hour. Area of the window opening — $0.4 \times 0.3 \text{ m}^2$, air speed — 1.25 m/s . Calculate the ventilation volume, frequency rate of air exchange in 1 hour. Compare the result with the hygienic standard. Make a hygienic assessment of the effectiveness of ventilation and air exchange rate.

HYGIENE OF NUTRITION

Task 1

Calculate total energy expenditure of the surgeon (age — 45, body weight — 76 kg; working day is 9 hours, sleeping — 8 hours, social activity — 4 hours, resting — 3 hours).

Task 2

Building worker (age — 45, body weight — 76 kg; working day is 9 hours, sleeping — 8 hours, social activity — 4 hours, resting — 3 hours) intakes 85 g of proteins, 105 g of fats and 325 g of carbohydrates. Calculate total energy intake and compare it with the total energy expenditure.

Task 3

The total energy expenditure of the machine operator (male, 45 y. o., 75 kg) is 2630 kcal. Calculate proteins, fats and carbohydrates physiological requirements by using the balanced Megacalorie.

Task 4

Calculate total energy expenditure of the student (female, 21 y. o., 57 kg). Calculate proteins, fats and carbohydrates physiological requirements by using the balanced Megacalorie.

Task 5

The total energy expenditure of the student (female, 21 y. o., 55 kg) increases on sports days (gymnastic) by 21 %. Calculate total energy expenditure using physical activity levels and proteins, fats and carbohydrates physiological requirements on regular and sports days by using balanced Megacalorie.

Task 6

Calculate total energy expenditure for teacher (male, 45 y.o., 75 kg; sleeps 8 hours, works 8 hours, low activity is 5 hours, high activity is 3 hours) using physical activity levels. Also find proteins, fats and carbohydrates physiological requirements by using balanced Megacalorie.

Task 7

The total energy expenditure of the student (male, 22 y.o., 65 kg; sleep 7 hours, studying 9 hours) increases on sports days (basketball practice, 1.5 hour). Calculate the total energy expenditure using physical activity levels and proteins, fats and carbohydrates physiological requirements on regular and sports days by using balanced Megacalorie.

Task 8

The total energy expenditure of the bank officer (female, 28 y. o., 45 kg; sleep 7 hours, work 9 hours) increases on sports days (aerobics, 1 hour). Calculate total energy expenditure using physical activity levels and proteins, fats and carbohydrates physiological requirements on regular and sports days using balanced Megacalorie.

Task 9

Nurse (female, 35 y. o., 65 kg) sleeps 8 hours, works 9 hours, has 5 hours of low activity and 2 hours of high activity per day. Intake of nutrients is 75 g of proteins, 100 g of fats and 350 g of carbohydrates.

Calculate her total energy expenditure, requirements for macronutrients, actual energy intake. Compare her actual energy intake and total energy expenditure, actual intake of nutrients and requirements.

Make a conclusion about her diet. Is it rational? How to improve her diet?

Task 10

Medical student (male, 22 y. o., 70 kg) sleeps 8 hours, works 8 hours, has 5 hours of low activity and 3 hours of high activity per day. Intake of nutrients is 60 g of proteins, 70 g of fats and 310 g of carbohydrates.

Calculate his total energy expenditure, requirements for macronutrients, actual energy intake. Compare his actual energy intake and total energy expenditure, actual intake of nutrients and requirements.

Make a conclusion about his diet. Is it rational? How to improve his diet?

Task 11

Building worker (male, age — 40, body weight — 80 kg; working day is 8 hours, sleeping — 8 hours, social activity — 4 hours, resting — 4 hours) intakes 75 g of proteins, 110 g of fats and 305 g of carbohydrates.

Calculate his total energy expenditure, requirements for macronutrients, actual energy intake. Compare actual energy intake and total energy expenditure, actual intake of nutrients and his requirements.

Write recommendations for improving nutrition.

Task 12

The patient complained of a feeling of weakness and pain in the legs, leg fatigue when walking. In an interview with the patient have been revealed significant errors in its food: high daily consumption of confectionery products, regular use in the nutrition of wheat bread flour, cream of wheat, and porridge cooked from polished rice. During palpation found pain calves. Excretion of

ascorbic acid in the urine was 0.2 mg/h. There is an increase in capillary fragility of the skin.

What vitamins deficiency causes similar symptoms?

Task 13

The patient complained of increased frequency of respiratory diseases and severe worsening ability to see objects at dusk. It is revealed that the patient is a strict vegetarian. Examination revealed follicular hyperkeratosis and disruption of normal color vision.

What vitamins deficiency causes similar symptoms?

Task 14

During the medical examination, the teacher complained of fatigue, decreased productivity, sleepiness, bleeding gums. Objective data: gingival margin loosened. Test for capillary resistance sharply positive. Excretion of the vitamin C in urine was 0.25 mg/hour.

Make an assessment of body supply with vitamin C. Calculate the requirement of vitamin C using balanced Megacalorie if total energy expenditure is 2250 kcal.

Task 15

The patient's (male, 45 y. o., 75 kg) total energy expenditure is 2510 kcal. The daily diet contains 110 g of cabbage as a vitamin C source. The content of vitamin C in cabbage is 36,6 mg per 100 g. During cooking average, vitamin C loss is 50 %. Objective data: decrease of skin capillary resistance. Excretion of ascorbic acid in the urine was 0.3 mg/h.

Make an assessment of body supply with vitamin C.

Task 16

Medical student (female, 21 y. o., 55 kg) sleeps 7 h, studies 10 h, has 4 h of low activity and of 3 h high activity. The daily diet contains 80 g of broccoli as a vitamin C source. The content of vitamin C in broccoli is 89 mg per 100 g. During cooking average, vitamin C loss is 55 %. Objective data: increase in capillary fragility of the skin, decreased productivity. Excretion of ascorbic acid in the urine was 0.29 mg/h.

Assess providing the body with vitamin C.

Task 17

Building worker (male, 55 y. o., 75 kg) sleeps 10 h, works 8 h, has 4 h of low activity and of 2 h high activity. The daily diet of patient contains 500 g of potato. The content of vitamin C in potato is 6 mg per 100 g. During cooking

average vitamin C losses is 50 %. Objective data: decrease of skin capillary resistance, weakness and pain in the legs. Excretion of ascorbic acid in the urine was 0.15 mg/h.

Assess providing the body with vitamin C.

Task 18

During assessing the nutritional status studied physical development of students. The obtained data were compared with individual arithmetic surveyed group (male, 20 years, time of working, sleeping, social activity 8 hours each).

| Sign | Individual data (a) | M | σ | Difference between individual data and M (a-M) | Sigma deviation (a-M)/ σ |
|---------------------|---------------------|-----|-----------|--|---------------------------------|
| Height | 178 | 175 | ± 2.3 | | |
| Weight | 75 | 72 | ± 2.1 | | |
| Chest circumference | 92 | 90 | ± 2.4 | | |

Draw a profile of physical development of student and assess it.

Task 19

During assessing the nutritional status studied physical development of students. The obtained data were compared with individual arithmetic surveyed group (female, 20 years, time of working, sleeping, social activity 8 hours each):

| Sign | Individual data (a) | M | σ | Difference between individual data and M (a-M) | Sigma deviation (a-M)/ σ |
|---------------------|---------------------|-----|-----------|--|---------------------------------|
| Height | 165 | 162 | ± 2.1 | | |
| Weight | 61 | 62 | ± 1.8 | | |
| Chest circumference | 80 | 82 | ± 2.0 | | |

Draw a profile of physical development of student and assess it.

Task 20

During assessing the nutritional status studied physical development of students. The obtained data were compared with individual arithmetic surveyed group (female, 20 years, time of working, sleeping, social activity 8 hours each):

| Sign | Individual data (a) | M | σ | Difference between individual data and M (a-M) | Sigma deviation (a-M)/ σ |
|---------------------|---------------------|-----|-----------|--|---------------------------------|
| Height | 160 | 162 | $\pm 2,1$ | | |
| Weight | 57 | 62 | $\pm 1,8$ | | |
| Chest circumference | 75 | 82 | $\pm 2,0$ | | |

Draw a profile of physical development of student and assess it.

Task 21

Student, 20 years old, body weight — 79 kg, height — 179 cm.

The diet contains 120 g of proteins, 165 g of fats, 480 g of carbohydrates, 120 mg of vitamin C, 1500 mg. Ca, 2800 mg. P, 600 mg. Mg, 18 mg. Fe.

Has three meals: breakfast — 20 %, lunch — 20 %, dinner — 60 %.

Calculate his total energy expenditure, the requirement of macronutrients, actual energy intake. Compare actual energy intake and total energy expenditure, actual intake of macronutrients and their requirements.

Compare actual intake of micronutrients and their requirements. Evaluate the distribution of energy by meals.

Determine the BMI, compare it with the norm.

Make a conclusion about his diet. Write recommendations for improving nutrition.

Task 22

Agricultural worker, 58 years old, body weight — 87 kg, height — 182 cm.

The diet contains 98 g of proteins, 135 g of fats, 500 g of carbohydrates, 150 mg of vitamin C, 900 mg. Ca, 1500 mg. P, 700 mg. Mg, 15 mg. Fe.

Has three meals: breakfast — 10%, lunch — 25%, dinner — 65%.

Calculate his total energy expenditure, the requirement of macronutrients, actual energy intake. Compare actual energy intake and total energy expenditure, actual intake of macronutrients and their requirements.

Compare actual intake of micronutrients and their requirements. Evaluate the distribution of energy by meals.

Determine the BMI, compare it with the norm.

Make a conclusion about his diet. Write recommendations for improving nutrition.

Task 23

By the timekeeping method has established that during the day a university student (20 years old, height — 171 cm, body weight — 68 kg) spends a certain amount of time on the following activities, in minutes:

- morning exercise and toilet — 20;
- walking — 90;
- riding in urban public transport (standing) — 150;
- attending lectures and classes in laboratories (sitting) — 480;
- classes in the sports section (basketball) — 80;
- eating (sitting) — 65;
- self-service activities (bed cleaning, laundry, etc.) — 90;
- sleep — 480.

Calculate the total energy expenditure and proteins, fats and carbohydrates physiological requirements on regular and sports days by using balanced Megacalorie.

FOOD POISONING

Task 1

In the settlement for two days in the clinic and ambulance turned 50 people with the same type of symptoms: fatigue, nausea, cramps and stomach pain, frequent diarrhea. The survey has revealed a common fact of cases for all of the affected - eating fried pastry stuffed with a liver. Patties bought at the same sales outlet - the buffet at the railway station.

A survey of the dining room and the buffet was established: manufacturing equipment for the production of pies modern, industrial sanitation rules observed, all staff underwent a medical examination, passed the tests for bacteria carrier.

Feedstock for the production of pies is centrally from a slaughterhouse. Party pies stuffed with a liver produced for the first time. It was baked at one and the same time, but the product sales lasted 2 days. Pies were sold in a heated state but didn't correspond to organoleptic properties of freshly baked products.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 2

A student came to the clinic to an ophthalmologist with complaints of sudden decreased visual acuity, double contours of objects, «grid» in front of his eyes. These symptoms had appeared the day before. The examination didn't reveal any pathology of the organ of vision, and the doctor asked in detail about the patient's nutrition. It turned out that everyone in the family, except for children, ate ham pork (ham is homemade and sent from the village).

Father, mother, and brother from the family of the student were called to investigate. Their symptoms were similar: headache, dizziness, weakness, fast heartbeat.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 3

In infectious hospital received 17 people diagnosed with food poisoning. The night before, the group of students celebrated the birthday of one of the cases in the

cafe. Menu affected: a salad of meat, sausage sandwiches and cheese, cucumber salad, barbecue, coffee, whipped cream. In 4–6 hours' students felt stomach pain, diarrhea, headache, dizziness, nausea, and vomiting has started.

After the inspection of cafes determined that the worker, who cook whipped cream, the day before had requested to the clinic because of whitlow on the right middle finger. She has been issued sick leave, but she returned to work.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 4

In the village, 3 families applied for medical help, presenting the following complaints: abdominal pain, repeated profuse vomiting, weakness, dizziness, cold sweat. 8 people got sick.

All the families consumed various foods on the day of the disease. Common to all the products was milk, which was systematically bought from a resident of a neighboring village. On the day before the disease, in all cases, milk was consumed without pre-boiling (it was added to coffee, cocoa, to dilute porridge).

The day before the disease, a woman selling milk warned customers about stopping delivering milk due to a veterinarian warning about the need to treat the cow for mastitis.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 5

In a family consisting of 6 people, almost all adults, except for an infant, fell ill at the same time. The disease began, about a day after eating pickled mushrooms at home. Against the background of normal temperature, the patients' pulse became more frequent, the patients became adynamic, there were complaints of a sharp deterioration in vision due to fog and mesh in front of the eyes, objects began to double. Upon admission to the hospital, the victims had drooping eyelids, the appearance of hoarseness of the voice, thirst, delayed stool. The consciousness of the patients is clear.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 6

One hour after eating soup with pies in the cafe 16 people asked for medical aid with complaints of general weakness, chills, headache, intense thirst, abdominal pain, nausea, vomiting, and diarrhea. Three of the patients later had convulsions and then — coma.

The investigation revealed that a young chef with a 10-day work experience added to the soup as a spice orange powder resembling powdered dried carrots.

On this day, rat extermination was to be made (by using zinc phosphide).

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 7

Five younger schoolboys crush kernels of apricots and ate them. After 5 hours, two children felt dizziness, headache, nausea, and general weakness (which have passed within 6 hours). One boy after 3 hours started vomiting, severe headache, dizziness, and diarrhea have appeared. For the two children who have eaten most kernels, all the above-mentioned symptoms were strongly expressed in 2 hours, one fainted. On examination, the doctor revealed such symptoms as cyanotic face and mucosal, conical and tonic spasms, trismus. The next day one child died. The condition of the other children improved after intensive therapy, and they have recovered.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 8

Wheat which contained a lot of weed seeds but hadn't been cleaned was ground and used for cooking pancakes. 10 hours after eating pancakes woman has felt a sharp pain in the lower back, extending to the back of the head while working in the garden. Then has felt a similar pain in the gastrocnemius muscles and the muscles of the arms, as well as «crawling chills» and sweating. This condition lasted for three days and then only weakness has remained. Several days later woman recovered.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 9

In the reception ward of the local hospital two children of the same family aged 4 and 6 were admitted in May with complaints of nausea, vomiting, frequent liquid stool. The disease began soon after eating boiled unpeeled potatoes. On examining the potatoes used in food by the family, many sprout and green samples were revealed.

What kind of poisoning can be assumed in this case? What caused the poisoning? Specify measures for the prevention of these poisoning.

Task 10

Mass illnesses began among the teachers and staff of the university campus, as well as students living in two dormitories. A total of 86 people got sick. The symptoms of the disease were expressed in the form of acute gastroenteritis (nausea, severe repeated vomiting, diarrhea, epigastric pain), headache, some had seizures. They had a weakening of cardiac activity, general weakness, dizziness also. The body temperature of most patients was normal. Condition of the most patients improved after 2 to 3 days.

From the survey of the patients, it was found out that they ate food bought in a university campus store. Among the products were meat, sausage and fish products, canned food, dairy products, juices, drinks, cream cakes. Only those who ate the cakes got sick.

During the investigation, it was found that the cakes were made in a confectionery at the store, where some of the original products in factory packaging (milk, cream, butter), as well as some of the cooked products (cakes, pastries) were stored not in the cold (due to insufficient refrigeration equipment), but at room temperature for 12 hours until the moment of sale. It was found that in samples of creams taken from unrealized cakes, *Staphylococcus aureus* was isolated.

HYGIENE OF CHILDREN AND ADOLESCENTS

Task 1

During the sanitary inspection of the educational secondary school, was found that building has three floors, located in the centre of a residential neighborhood, distance from the red line is 35 m. Building was built according to a standard project, designed for 1,320 children (1,440 children are actually studying). Classes are held in two shifts. On the territory of the school there are sports and educational zones, as well as an economic yard; green spaces occupy 48 % of the territory.

The classrooms ($6.2 \times 8.2 \times 3.1$ m) are equipped with standard equipment. Students of the 3rd–4th grades study in the same room in different shifts. Provided desks of the 3rd–4th groups located along the classroom in three rows.

The occupancy rate of junior classes is 46–47 people. The air temperature in the classroom by the end of the second shift is 24 °C with a relative humidity of 91 %. Ventilation is carried out by the ventilation openings and windows. CO₂ content in the air — 1,8 ‰. Artificial lighting is provided by 16 incandescent lamps 75 watts each. They are equipped by semi-reflective panels arranged in two rows parallel to the line of windows.

An analysis of the curriculum and the workload of students showed that the maximum number of hours per week for students in grades 1–4 is 28; grades 5–8 is 34; grades 9–11 — 36.

The school has a cafeteria with 120 seats; it works on semi-finished products. A washbasin is equipped in a specially designated area of the dining room. Of the 4 available electric sheds, 2 are in a faulty condition. Two-hole baths are used for washing dishes.

The nutrition of students is regulated by a special schedule, according to which high school students eat after the 2nd lesson, younger students — after the 3rd.

Make a conclusion about the placement of the school, compliance with the norms of the area, the state of the microclimate and illumination in classrooms.

Evaluate the occupancy of classes, the educational load and the organization of meals for students.

Task 2

The school has opened a new computer lab for high school students. The class area is 37 m², height — 3 m. Two windows are oriented to the south. The walls of the classroom at a height of 1.5 m are painted with dark blue oil paint. The walls of the panels and the ceiling are whitewashed.

The air temperature in the computer classroom in the warm season reaches 26–27 °C with a relative humidity of 80–85 %. The windows in it can't be open, as they are equipped with metal grilles.

There are 12 work places in the classroom. Illumination on the keyboard — 75 lux, on the monitor screen — 30 lux (incandescent lamps). The noise level during computer operation is 60 dbA.

Stools are used instead of chairs. Classes are conducted by a software engineer. The duration of classes is 1.5 hours, without a break.

Give a hygienic assessment of the placement of the computer class, compliance with the norms of the area allocated to the workplace, the state of the microclimate, illumination, noise in it, etc. List the measures to eliminate the identified shortcomings.

Task 3

12 students are engaged in the classroom with a depth of 6.2 m, a length of 8 m, a height of 3.1 m. By the end of classes, the CO₂ concentration was 0.18 % at a temperature of 23 °C and a relative humidity of 82 %. Illumination by the luminescent lamps measured on the blackboard — 350 lux, on the work places — 250 lux.

The duration of classes is 1.5 hours, with a 5 minutes break after the first 45 minutes.

Give a hygienic assessment of the microclimate, ventilation and illumination at classroom. Evaluate the organization of classes for students.

Task 4

During assessing the physical development of child, the individual data need to be compared with average statistical values for the age of the child (female, 9 years).

| Sign | Individual data (a) | M | σ |
|---------------------|---------------------|--------|------------|
| Height | 128 | 132.52 | ± 6.24 |
| Weight | 26.5 | 28.06 | ± 4.97 |
| Chest circumference | 60 | 62.44 | ± 4.62 |

Draw a profile of physical development of child and assess it.

Task 5

During assessing the physical development of child, the individual data need to be compared with average statistical values for the age of the child (male, 11 years).

| Sign | Individual data (a) | M | σ |
|---------------------|---------------------|--------|------------|
| Height | 151.5 | 142.22 | ± 7.11 |
| Weight | 37 | 34.62 | ± 6.10 |
| Chest circumference | 71.5 | 68.27 | ± 4.93 |

Draw a profile of physical development of child and assess it.

HYGIENE OF HEALTH CARE INSTITUTIONS

Task 1

In the hospital ward for post-infarction patients in November, the parameters of the microclimate were: the air temperature in the midday hours was $19\text{ }^{\circ}\text{C}$ (changes during the day reached $\pm 4\text{ }^{\circ}\text{C}$) with a 78 % humidity.

The cooling capacity of the air was studied by a cylindrical kata thermometer ($F - 690\text{ Mcal/cm}^2$, the cooling time of the device from 38 to $35\text{ }^{\circ}\text{C}$ was 90 seconds).

Find the effective temperature (ET). Evaluate the parameters of the microclimate taking into account the pathology of patients.

Task 2

There are 5 people in the ward of 90 m^3 volume. Ventilation of the ward is realized by opening the window for 10 minutes every hour. Area of the window opening — 0.15 m^2 , air speed — 1 m/s . Calculate the ventilation volume, frequency rate of air exchange in 1 hour. Compare the result with the hygienic standard. Make a hygienic assessment of the effectiveness of ventilation and air exchange rate.

Task 3

There is a septic and aseptic department in the operating unit of the hospital. The premises of the block are divided into a sterile zone, a restricted mode zone and a general mode zone. The area of the general surgery operating room is 23 m². The ratio of septic and aseptic area is 1 : 3. The operating unit is located on the ground floor of the main hospital building. The direction of the windows is north. There is a supply and exhaust ventilation, artificial. Evaluate the project of the operational unit and suggest actions to improve it.

Task 4

The neurological department of the city hospital is located on the 5th floor of the therapeutic building. It consists of two sections with 30 beds each. There are 2, 3, 4 beds in the wards. At the time of the inspection, there were 72 patients in the department. In some wards, patients are placed on extra beds. The width of the corridor is 2.1 m. Half of the wards have a northeastern orientation, the other — southwestern.

There are four patients in the ward with a depth of 5 m, a width of 4.8 m, a height of 3.2 m, one of whom does not get out of bed. The distance between the beds is 0.8 m. The walls are 1.8 meters high, painted light gray, the ceiling is whitewashed, the floor is covered with linoleum. There is a sink with hot and cold water in the ward.

When studying the microclimate (July), the temperature of the dry bulb of the psychrometer August was 23 °C, the wet bulb was 19 °C. The factor of the cylindrical kata thermometer equal 680 Mcal/cm², cooling time is 158 seconds. The atmospheric pressure is 740 mm Hg. The two windows of the ward are directed to the southwest. The height of the windows above the floor is 2.8 m. The glazing area of the windows is 5.2 m². The lighting in the wall opposite the window during the study was 160 lux, outdoor lighting — 12 200 lux. Artificial lighting is provided by four reflected light from incandescent lamps (150 Watts). Ventilation system without mechanical drive, ventilation volume per hour — 238 m³. The CO₂ content in the air chamber was 0.19 %, the dust — 0.28 mg/m³, microbial contamination of air — 2900 microbial cells in 1 m³ including pathogenic staphylococcus — 8 in 1 m³.

Make a hygienic conclusion about the condition of the indicators.

Task 5

Allergy department of the city hospital is located on the 3th floor of the therapeutic building. It consists of section with 11 beds each. There are 2-bedded wards (12 m²), 3-bedded wards (17 m²), 4-bedded wards (25 m²). At the time of the inspection, there were 35 patients in the department. Half of the wards have a north orientation, the other — west.

When studying the microclimate (December), the temperature of the dry bulb of the psychrometer August was 17 °C, the wet bulb was 14 °C. The factor of the cylindrical kata thermometer equal 610 Mcal/cm², cooling time is 68 seconds. The atmospheric pressure is 758 mm Hg. The height of the windows above the floor is 2.7 m. The glazing area of the one window is 2.2 m². The natural light inside during the study was 320 lux, outdoor lighting — 13400 lux. Artificial lighting is provided by two luminescent lamps (80 Watts). Ventilation volume per hour — 114 m³ (3 patients ward). The CO₂ content in the air chamber was 0.11 %, the dust — 0.15 mg/m³, microbial contamination of air — 100 microbial cells in 1 m³ including pathogenic staphylococcus — 1 in 1 m³.

Make a hygienic conclusion about the condition of the indicators.

Task 6

Parameters of the hospital ward: depth — 6.5 m, length — 8 m, height — 3.2 m, distance from the upper edge of the window to the ceiling — 35 cm. With outdoor illumination in the open air at 7800 lux, the CNL currently in the ward is 1.2 %.

There are 5 patients in a ward. The CO₂ content at the time of the research was 0.19 %. Microbial contamination of air — 152 microbial cells in 1 m³ including pathogenic staphylococcus — 10 in 1 m³.

The air temperature here, according to the readings of the dry thermometer of the August psychrometer, is 22 °C, wet — 20 °C, the kata thermometer factor is 518 Mcal/cm², the cooling time of the device from 38 to 35 °C was 120 seconds, the barometric pressure was 755 mm Hg.

If the effective temperature is not included in the comfort line, tell me how to change the parameters of the microclimate so that it enters it.

Evaluate the condition of environment in the hospital ward.

OCCUPATIONAL HYGIENE

Task 1

The plant of reinforced concrete products manufactures wall panels and other parts for industrial housing construction. Concrete workers of the molding shop prepare the molds, fill them with a concrete mixture, and mold products on vibrating platforms using molding machines.

The vibration platforms are mounted on rigid rubber supports.

When forming products, workers have to level the concrete mixture with a metal shovel while standing on the floor. When forming large-area concrete panels, they are forced to rise onto the vibrating surface of the concrete mixture. The vibration velocity levels at the workplace (on the floor) were 105 and 108 dB

at the average geometric frequencies of the octave bands 31.5 and 63 Hz. Workers are exposed to vibration for 2 hours with a working shift of 7 hours.

Evaluate the vibration levels and duration of its effect on workers, comparing them with existing sanitary standards. What occupational diseases can cause the effect of vibration?

Task 2

In the electroplating shop of a machine-building plant, the coating of parts with various metals (nickel, chromium, zinc, copper, etc.) is produced in baths by electrodeposition from aqueous solutions of salts. The temperature of the solutions is 40 °C. Parts before coating, as a rule, are cleaned from rust, grease and other contaminants in degreasing baths with alkali solutions followed by etching with mineral acid solutions. The temperature of these solutions is 70–80 °C. The worker servicing the line suspends the parts (weight up to 10 kg) on special suspensions and monitors the process. The transfer of parts from one bath to another is mechanized. The baths are equipped with local exhaust ventilation (on-board suction).

The excess of heat in the shop is 5 kcal/m³/h.

When studying the parameters of the microclimate in the workplace, it was found that the air temperature in the winter months is 18–20 °C at a relative humidity of 75–80%, the air velocity is 0.3–0.5 m/s.

Name the devices that were used to measure the parameters of the microclimate. Give an assessment of the weather conditions in the workshop. Determine the ways of heat transfer for those working under these conditions.

Task 3

Caisson works during the construction of the bridge supports across the river D. were carried out mainly at a depth of 12 m. Under what pressure did the caisson workers have to perform work under these conditions. What are the symptoms of caisson disease?

Task 4

Diving operations when lifting a ship sunk in the sea were carried out at a depth of 25 m. It is known that for every 10 m of immersion, the pressure increases by 1 atm (101.3 kPa).

How will the pressure change at the depth of the dive? What kind of occupational disease is possible to develop? List preventive measures.

Task 5

At the workplace of an electric welder of a machine-building plant, the dustiness of the air environment was investigated by the aspiration method. The mass of the filter before dust extraction is 360 mg, after sampling — 371 mg,

the duration of aspiration is 20 minutes at an aspiration rate of 25 l/min. The air temperature at the sampling site is 19 °C, the barometric pressure is 753 mm Hg.

Bring the volume of stretched air to normal conditions, determine the dust concentration. Chemical analysis of the dust revealed manganese oxide in the range of 6.8 % and silicon dioxide — 9 %.

Determine the degree of dustiness of the air at the place of work of the electric welder by comparing the data with the MPC. Name occupational diseases that may occur in workers of this profession.

Task 6

An air sample for dust content in the products manufacturing room was taken by the aspiration method. The filter weight before sampling is 335 mg, after sampling — 343 mg. The duration of aspiration is 25 minutes at an aspiration rate of 20 l/min. The air temperature at the sampling site is 20 °C, the barometric pressure is 748 mm Hg.

Determine the concentration of dust in the air, bringing the volume of stretched air to normal conditions.

Does the dust concentration correspond to the MPC if the SiO₂ content in it is more than 70 %?

Task 7

A worker-machinist of a mining combine harvester is mining sylvinites at a depth of 280 m. Atmospheric pressure on the earth's surface is 750 mm Hg. Under what pressure does the machinist work?

What is the expected thermal feeling of the driver? Find it with the help of effective temperatures and the cooling capacity of the air, if the time of the fall of the alcohol column of the cylindrical kata thermometer from 38 to 35 °C was 220 sec, the factor of device = 620 Mcal/cm², the readings of the dry thermometer of the station psychrometer 28.5 °C, wet — 26 °C.

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SITUATIONAL CASE TASKS OF GENERAL HYGIENE

Сборник задач
На английском языке

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