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

AIR ENVIRONMENT HYGIENE

Study manual for practical exercises
for foreign 2nd year students of General Medicine Faculty



MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION

FEDERAL STATE BUDGET EDUCATIONAL INSTITUTION OF HIGHER EDUCATION
"DAGESTAN STATE MEDICAL UNIVERSITY"

AIR ENVIRONMENT HYGIENE

Practical Coursebook for 2nd-Year International Students
of the Faculty of General Medicine

Electronic publication

Saint Petersburg
Naukoemkie technologii
2026

© Authors, 2026
ISBN 978-5-00271-127-7

UDC 614.71
LBC 51.21
A36

Authors:
M. G. Magomedov – doctor of Medical Sciences, professor of the Department of general hygiene and human ecology DSMU;
U. A. Magomedova – senior lecturer of the Department of general hygiene and human ecology DSMU;
P. M. Ibnumaschudova – senior lecturer of the Department of general hygiene and human ecology DSMU;
R. G. Suleymanova – candidate of medical Sciences, associate Professor of the Department of normal physiology DSMU;
P. Sh. Gitinova – candidate of medical Sciences, associate Professor of the Department of general hygiene and human ecology DSMU

Reviewers:
R. I. Isaeva – candidate of medical Sciences, associate Professor of the Department of microbiology DSMU;
A. E. Azizkhanova – candidate of philological Sciences, associate Professor Department of foreign and Latin Manakin DSMU

A36 Air environment hygiene [Electronic resource]: Practical Coursebook for 2nd-Year International Students of the Faculty of General Medicine / M. G. Magomedov, U. A. Magomedova, P. M. Ibnumashudova, R. G. Suleymanova, P. Sh. Gitinova. – Saint Petersburg, Naukoemkie technologii, 2026. – 98 p. – URL: https://publishing.intelgr.com/archive/Air-environment-hygiene.pdf.

ISBN 978-5-00271-127-7

The manual, taking into account the modern requirements of medical science, reveals main issues of organizing sanitary and hygienic control and assessing the impact of eco-hygienic environmental factors on public health in the «Air environment hygiene» section. At the end of each lesson, an approximate layout of a properly designed protocol for a sanitary and hygienic study is given.

Much attention is paid to illustrations of instruments at the stages of laboratory research of the examined hygienic factors, which is intended to facilitate the development of the discipline by students.

The section ends with a final lesson, outlining the main questions on the theoretical and practical parts of the topics covered, situational tasks, approximate topics for reports, questions for independent work and test tasks.

A list of basic and additional literature, as well as regulatory documents, is provided.

The publication was prepared in accordance with the requirements of federal state educational standards and recommended by the Federal State Budgetary Educational Institution of Higher Education «DSMU» of the Ministry of Health of the Russian Federation as a textbook for students studying in the areas of training "General Hygiene" and is intended for 2nd year foreign students Faculty of Medicine.

ISBN 978-5-00271-127-7 © Authors, 2026

Educational publication

Magomedov Magomed Gitinomagomedovich
Magomedova Umiyat Abdulbasirovna
Ibnumashudova Patimat Magomedovna
Suleymanova Raisa Gereikhanovna
Gitinova Patimat Shuapandievna

Air environment hygiene

Practical Coursebook for 2nd-Year International Students
of the Faculty of General Medicine

Electronic publication

Published in the author's edition
Layout *Y. N. Safonkina*
Chief-in-Editor *V. M. Korovin*

Signed for use on 23.04.2026.
The edition volume 3.5 MB

Naukoemkie technologii, Publishing House
Intel Group Corporation, Ltd.
website: https://publishing.intelgr.com
E-mail: publishing@intelgr.com
Tel.: +7 (812) 945-50-63

ISBN 978-5-00271-127-7



TABLE OF CONTENTS

PREFACE 5
LIST OF ABBREVIATIONS 6
INTRODUCTION 7
LESSON 1
History of the of hygiene. Subject, content, relationship between hygiene and ecology. Classification of types of reactions of the human body to the influence of environmental factors. Hygienic diagnostics of human health and environmental conditions. Hygienic standardization. Principles of hygienic regulation 8
LESSON 2
Measuring temperature (thermometry) and barometric pressure (barometry) 24
LESSON 3
The importance of air humidity as a hygienic factor. Determination of air humidity (psychrometry and hygrometry) 43
LESSON 4
Determination of movement speed (anemometry) and cooling properties of air (catathermometry) 56
LESSON 5
Determination of the light regime in the room (luxmetry) 71
LESSON 6
Final lesson on the section "Hygiene of the air environment" 87
References 97

PREFACE

While working on this edition of the manual, the authors tried to introduce everything new and valuable that has appeared in recent years. The shortcomings were eliminated and the wishes of reviewers and students expressed about our modest work were fulfilled.

The authors will gratefully accept all comments made by teachers and students, as well as sanitary doctors, after the publication of this work in order to further improve the teaching of the hygiene course to foreign students of the Faculty of Medicine.

LIST OF ABBREVIATIONS

WHO	–	World Health Organization
R	–	Reaumur scale
F	–	Fahrenheit
K	–	Kelvin scale
C	–	Celsius
MAC	–	Maximum acceptable concentration
ASEL	–	Approximately safe exposure level
UVR	–	Ultra-violet rays
GIT	–	Gastrointestinal tract
CI	–	Cardiac ischemia
CVS	–	The cardiovascular system
SanPiN	–	Sanitary rules and regulations
SNiP	–	Building regulations
GOST	–	State standard

INTRODUCTION

RELEVANCE: Air is one of the most important elements of the environment surrounding humans. The air environment is necessary for the respiration of humans, animals, and plants. It is also a reservoir that receives gaseous metabolic products.

During hygienic assessment of air, physical properties are taken into account: temperature, humidity, speed, barometric pressure, electrical state, radioactivity, solar radiation intensity; chemical composition – the content of normal components and foreign impurities, mechanical impurities – the content of dust, smoke; microorganisms – the number of bacteria, their pathogenicity. Each of these factors can have a direct impact on the body, but in nature they act simultaneously and we can only talk about the predominant importance of one of them.

Purpose of the lesson:

to acquaint students with the impact of air on the human body and the principles of standardization of its individual parameters.

Student must know:

the influence of microclimatic conditions on the human body, criteria for hygienic assessment of microclimate parameters, design and operation of instruments for determining atmospheric pressure, temperature, humidity and air mobility.

Student must be able to:

determine the main parameters of the air environment, give a hygienic assessment and develop preventive measures.

LESSON 1

History of the of hygiene.
Subject, content, relationship between hygiene and ecology.
Classification of types of reactions of the human body to the influence of environmental factors.
Hygienic diagnostics of human health and environmental conditions.
Hygienic standardization. Principles of hygienic regulation

1. Hygiene as a science

Hygiene (Greek – healthy) is a science that studies the patterns of environmental influence on the human body and public health in order to develop hygienic standards, sanitary rules and measures that would provide optimal conditions for life, health promotion and disease prevention.

Hygiene tasks:

1) the first task of hygiene is aimed at improving environmental conditions, is to identify cause-and-effect relationships between the impact of environmental factors on the body and possible changes in human health.

2) the second task of hygiene, which involves influencing the human body itself, is the development of means and methods for increasing the body's resistance to the influence of negative environmental factors. These means and methods are: a healthy lifestyle, personal hygiene, hardening the body, rational nutrition, rational clothing and shoes, physical activity.

Environmental factors that have a constant impact on humans include, first of all, air, water, and soil. It is known that the human body is in constant interaction with the environment and this is manifested, first of all, in the commonality of their chemical composition and the constant dependence of the conditions of human existence on the physical conditions of the external environment. Since all environmental factors – chemical, physical and biological – are in constant development, this has a direct impact on one of the essential features of the human body – adapting to minor changes in environmental factors, i. e. the body's ability to adapt. However, the adaptive

capacity of the human body is not unlimited. Minor changes in environmental factors, as a rule, do not cause painful phenomena in humans, and, on the contrary, significant deviations of environmental parameters from the requirements of the human body can lead to various functional changes in the body and ultimately to the development of diseases.

In this regard, environmental hygiene faces two main tasks:

– determine optimal environmental conditions for human life;

– limit or eliminate the harmful effects of the environment on the body, i. e. bring the external environment into line with the requirements of the human body.

At the same time, when assessing the influence of various environmental factors on the human body, a predominant factor is usually identified, which in its parameters has the greatest deviation from the requirements of the human body.

2. Main stages in the development of hygiene

The concept of «hygiene» dates back to ancient times. The science of preserving and strengthening public health through preventive measures. Hygieia is the daughter of the god of medicine Asclepius, depicted as a beauty with a cup in her hand entwined with a snake – the goddess of health, who healed with the sun, water and air, and maintaining the purity of the body. Her other sister, Panacea, treated with medicines.

In Greece, in the temples, much attention was paid to the climate, washing, vaporization, and fasting. Hygiene flourished in Ancient Rome. In the Middle Ages there was a decline in hygiene. Hygiene is being revived in the 19th century.

Hygiene began to develop intensively from the middle of the 19th century with the growth of capitalism, which led to the accumulation of people in cities, the growth of hazardous production and the increasing frequency of large epidemics of cholera, plague, and typhus. And then systematic scientific research in the field of hygiene began.

Max Pettenkofer (1818–1901), German scientist-doctor, founder of hygienic science: introduced experimentation into hygiene, turning it into an exact science. Proposing to improve the environment, he outlined ways to prevent many diseases.

For the first time he drew attention to personal hygiene as an important factor in many diseases: “the extent to which a person has personal hygiene, such is his path through life and such is his speed to death.”

In Rus', hygiene as a system of skills arose earlier than in the West. Peter 1 introduced a system of medical and sanitary support for the Army, since in all the armies of the world a large number of soldiers died not in battles, but in diseases (cholera, dysentery, typhus).

The founders of Russian health care, the therapist M.Ya. Mudrov and obstetrician S. G. Zybelin, played a major role in the development of hygiene.

It is necessary to know about three domestic scientists who played a fundamental role in the development of domestic hygiene.

A. P. Dobroslavin (1842–1889) – created the first department of hygiene (1871) at the St. Petersburg Military Medical Academy; published the first Russian textbook on hygiene, began publishing the magazine “Health”, opened the first experimental hygienic laboratory, organized the Russian Society for the Protection of Public Health and Women’s Medical Education in Russia; developed the basics of communal hygiene.

F. F. Erisman (1842–1915) – founded the Department of Hygiene at Moscow University (1882), the Hygienic Institute with a city sanitary station for the study of food, water and soil; developed problems of school hygiene and food hygiene; published a three-volume manual on hygiene.

G. V. Khlopin (1863–1929), a student of Erisman, made hygiene mandatory in laboratory research and experimentation, and published manuals on the basics of hygiene and general hygiene.

Laws of hygiene.

For memorization, the six laws of hygiene on the impact on the environment can be combined into three “negative”, two “positive” and one “technological”.

1. "Negative" laws:

a) The law of the negative impact of human activities on the environment: industrial and domestic. The lower the scientific and technological progress in the

country, the greater the environmental pollution and its impact on the health of the people living here;

b) The law of the negative impact of natural extreme phenomena on the environment – volcanoes, earthquakes, solar flares, etc;

c) The law of the negative impact of environmental pollution on public health: no matter what these pollutions are, they reduce immunity, cause frequent illnesses, and accelerate old age and death.

2. "Positive" laws:

a) The law of the positive impact on the environment of human society – in order to survive, it has to accept laws and measures to limit the harmful effects of scientific and technological progress on humans, reducing the level of pollution.

b) The law of the positive influence of natural factors – sun, air, water and quality food – on human health.

3. "Technological" law:

Violation of public health (disease, impaired immunity, etc.) is possible in the presence of 3 driving forces: a) a source of harm; b) factors and mechanisms.

Classification of types of reactions of the human body to the influence of environmental factors:

1. Natural and anthropogenic environmental factors can contribute to, ensure the harmonious physical, mental, spiritual development of a person, the normal functioning of systems, organs, tissues, protect and strengthen human health.
2. Separately, together, combined or complexly can be used in the prevention, diagnosis and treatment of diseases.
3. They can cause disorders in the human body that are incompatible with life and death.
4. They can have a beneficial effect on the process and outcome of an advanced disease, and help reduce the risk of chronic disease.
5. They can cause the development of diseases with a complex of symptoms typical of a specific nosology.

6. Ecological factors can cause pathophysiological changes in the body of uncertain significance, as precursors of nosologies.

7. Ecological factors can contribute to the formation of atypical signs of diseases.

8. They can contribute to a decrease in the effectiveness of treatment, prophylactic, rehabilitation measures, lead to an increase in the frequency of complications after radical methods of treatment, and worsen long-term treatment results.

9. May contribute to the chronicization of pathological conditions.

10. May help increase the relapse rate of chronic diseases.

11. The unfavorable influence of environmental factors reduces the quality and productivity of breasts, contributes to the development of fatigue and overwork, and increases the recovery period for physiological changes as a result of work activity.

12. Environmental factors can contribute to a reduction in human life expectancy and reduce the quality of life and health.

13. Long-term consequences of exposure to low-intensity environmental factors can be: a) mutagenic; b) teratogenic; e) allergenic; c) blastomogenic; d) immunosuppressive; f) gerontogenic;

14. It is recommended to evaluate the topics of practical classes in General Hygiene and Human Ecology from the standpoint of hygienic diagnosis, types of body reaction to the influence of environmental factors.

Hygiene and Human Ecology department chairman in 1986–2015, Academician of the Russian Academy of Natural Sciences, Professor J. G. Khachirov.

3. Human ecology

Ecology (Greek – the study of the house) is the science of the relationships between flora and animal organisms, and the communities formed by them among themselves and with the environment.

The term “ecology” was proposed by the German scientist E. Haeckel in 1866. In general, the problems of big ecology cover all issues of the life activity of all living

organisms. Therefore, in relation to the subjects of study, ecology is divided into the ecology of any living creature – microbes, plants, animals, etc.

Human ecology – studies the influence of environmental factors on humans and, in turn, the influence of humans and groups of people on the environment. Closely related to it is medical ecology, which studies human diseases caused by a polluted environment and ways to prevent them. The health of the population in any territory is the best indicator of the state of its habitat.

Human ecology is part of ecology – that is, all life on Earth. If the science of ecology studies the ways of life and survival of all living beings on Earth, then human ecology studies how humans can survive, especially in an era of overpopulation and increasing pollution of the Earth. The problem of human ecology is the search for methods of moral and spiritual education of man, so that he realizes his place in nature and does not spoil it.

Medical ecology is a part of human ecology that studies environmental human diseases.

If for a person ecology is a place of residence with every second communication with surrounding factors – microclimate, air, water, food, etc., with which the body is in constant contact and struggle for survival, then hygiene is a tool that studies the influence of human living conditions in environmental conditions, how they affect his health, performance and life expectancy, and based on this study, develops recommendations for reducing the risk of harmful environmental influences on health.

4. Sanitation

Sanitation is the practical implementation of hygienic norms and rules. If hygiene is a science with recommendations for maintaining and improving health, then sanitation is a practical human activity with the help of which the implementation of hygienic rules is achieved. But in life, “I know and I do / but I don’t do it” or “I don’t know and I don’t do it” – this is the level of a person’s sanitary culture.

Using hygienic knowledge, sanitation helps a person to survive, prolong life and reproduce.

5. <u>The relationship between hygiene, ecology and sanitation</u>

You can navigate the relationship between these disciplines using the following mottos: “ECOLOGY – I LIVE!”, “HYGIENE – I KNOW HOW TO DO!” and “SANITATION – AND I DO THIS LIKE THIS!”

Another example of the relationship between these disciplines: a mosquito bite is ecology; I know that it can cause malaria, I need to get vaccinated – this is hygiene; I slam/don’t slam it, I give/don’t vaccinate against malaria – this is sanitation.

Ecological section – study of environmental factors and their properties; in the hygiene section – the study of the impact of these factors on human health and the sanitation section – familiarization with recommendations on ways and means of limiting these harmful effects and developing useful skills.

Training a modern paramedic, midwife or nurse in modern conditions is unthinkable without hygienic knowledge, which is closely related to the ecological worldview, prevention and clinical medicine.

Hygienic knowledge concerns issues of nutrition, labor, hospital design, healthy lifestyle, etc.

Hygiene recommendations for creating a healthy lifestyle come first, and then medications.

Therefore, a medical professional in the field of hygiene and human ecology **should know:**

1. the main ecological environmental factors affecting people in their places of residence and work;
2. patterns of influence of these factors on human health;
3. methods of sanitary and hygienic assessment of environmental factors in which a person lives and works in order to anticipate the occurrence of disease and give recommendations on how to avoid or reduce the health risks of exposure to factors;
4. methods of sanitary educational work and be able to carry it out among people, considering environmental factors and the corresponding sanitary and hygienic recommendations.

6. Hygienic diagnostics of human health and the state of the environment

The term “hygienic diagnostics” was mentioned back in 1885 by the founder of domestic hygiene A. P. Dobroslavin.

“Diagnosis” translated from Greek means recognition, determination. It is quite obvious that it is possible to recognize or determine not only the symptoms of diseases, but also the level of health of healthy people. Unlike clinical hygienic diagnostics, it is not aimed at establishing the fact of the disease, but at identifying, firstly, those conditions that can cause the disease, and secondly, changes in the body that indicate pre-disease. For a long time, hygienic science has been developing the direction of studying the human environment – air, water, food, working conditions, living conditions, and other factors that influence a person and his health were studied. Another object of hygiene – a person – has not been studied enough by hygienists. Therefore, in modern conditions, scientists are paying more and more attention to pre-nosological diagnostics, a complex of physiological, biochemical, immunological and other studies that make it possible to establish the level of health and identify the pre-disease state of the body.

According to modern concepts (Koshelev N. F., Terentyev L. P., 1989) **“hygienic diagnostics is** a system of thinking and action aimed at studying the state of the natural and social environment, human health (population) and establishing dependencies between the state of the environment and health ". Modern methodology obliges us to evaluate human health and illness from the standpoint of the relationship between the social, spiritual and biological. There are many definitions of health (more than a hundred), which indicates the absence of a generally accepted unified understanding of this phenomenon. The most common definition is given in **the preamble** of the WHO Constitution (1948): “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”

Various methods are used to measure a person's physical condition. (Anthropometric – height (standing), body weight, volume of the chest, abdomen, shoulder, etc. – these indicators are called somatometric). Physiometric indicators include hand strength, deadlift strength, lung capacity, etc.

To identify adaptive capabilities (reserves), stress tests are used – with squats, push-ups, climbing stairs (step test), pull-ups; bicycle ergometry.

The listed indicators are called direct indicators of health; they directly characterize the structure, function and adaptive capabilities of the body.

It is more difficult to assess a person's mental state and health. This requires special tests, which are used by psychophysiologists, and often an examination by a psychiatrist. WHO expert on psychiatry N. Sartorius (1983") believes that "mental health can be given three definitions: firstly, mental health is the absence of severe mental disorders; secondly, mental health is

this is a certain reserve of a person's strength, thanks to which he can overcome unexpected stress or difficulties that arise in exceptional circumstances; thirdly, mental health is a state of balance between a person and the world around him, a state of harmony between him and society, the coexistence of the ideas of an individual with the ideas other people about objective reality. This state of balance does not exclude disability; it can persist even in the presence of the disease."

The greatest difficulty arises in assessing the third element of the definition of health given in the WHO Constitution – social well-being. It has no standards and can vary significantly depending on the needs and capabilities of people.

The definition of health discussed above refers to the individual, the health of the individual. It cannot be applied to public health (population, population), since in society there are always physically and mentally sick, dying, etc.

To characterize the health of the population, medical-demographic and medical-statistical indicators are used.

The first include birth rate – the number of births per year per thousand of the population, mortality – the number of deaths (in ppm), natural population growth – the difference between the numbers of births and deaths (in ppm), the average life expectancy (number of years) of life of men, women and the population in in general.

Medical and statistical indicators include, first of all, morbidity (general, occupational, age and gender). In accordance with the International Classification of Diseases (ICD, tenth revision), there are about a thousand human diseases, grouped

into 17 classes – infectious and parasitic diseases – the first class, endocrine and metabolic diseases – the second, etc. All cases of requests for medical help (total morbidity in pro mille) characterize the level of morbidity. The percentage of visits by type of pathology (classes of diseases) is called the morbidity structure.

In addition, medical statistics use such indicators as work losses due to illness, hospitalization, disability, premature mortality, etc.

The listed indicators characterize the ill health of the population and are called morbid.

The science that studies health at the population level is social hygiene. It examines the influence of all factors on the state of public health (the health of various professional and social groups. Based on health status, they are divided into three groups:

I – healthy;

II – almost healthy;

III – those in need of dynamic medical supervision.

As can be seen from this classification, the basis for the distribution into health groups is the principle of the absence or presence of disease.

In the sphere of interests of hygiene, first of all, healthy people are concerned, although hygienic recommendations, norms and rules apply to all categories of the population.

Changes in the state of human health occur as a result of the natural processes of biological aging, as well as under the influence of conditions and factors of its existence.

The health of each person depends not only on environmental factors, but also on the individual biological characteristics of the individual, characterized primarily by his genotype, gender and age.′

Factors that determine health include, first of all, the degree of intensity and working conditions; the presence of occupational hazards; living conditions; nature of nutrition; level of culture; Lifestyle; the level of development of the country's economy; economic well-being of the region; the number of real wages; health status and others.

The bulk of these factors relate to living conditions, i. e., to the socio-economic sphere, which, according to scientists, determines 49–53% of health status. Another 18–20% of health depends on heredity, 17–20% on the environment, and only 8–10% on health care, i. e., directly from the activities of medicine.

Public health depends on a complex of factors that are different in nature, direction and strength. Its study is complicated by the fact that these factors interact with each other, change over time, and their influence on the levels of health indicators is far from the same in different regions of our country.

The connection between risk factors and health is discussed in all chapters of the textbook. In relation to each section of hygiene, factors can be general (microbiological in food hygiene, water supply, etc.) or specific (radiation factor).

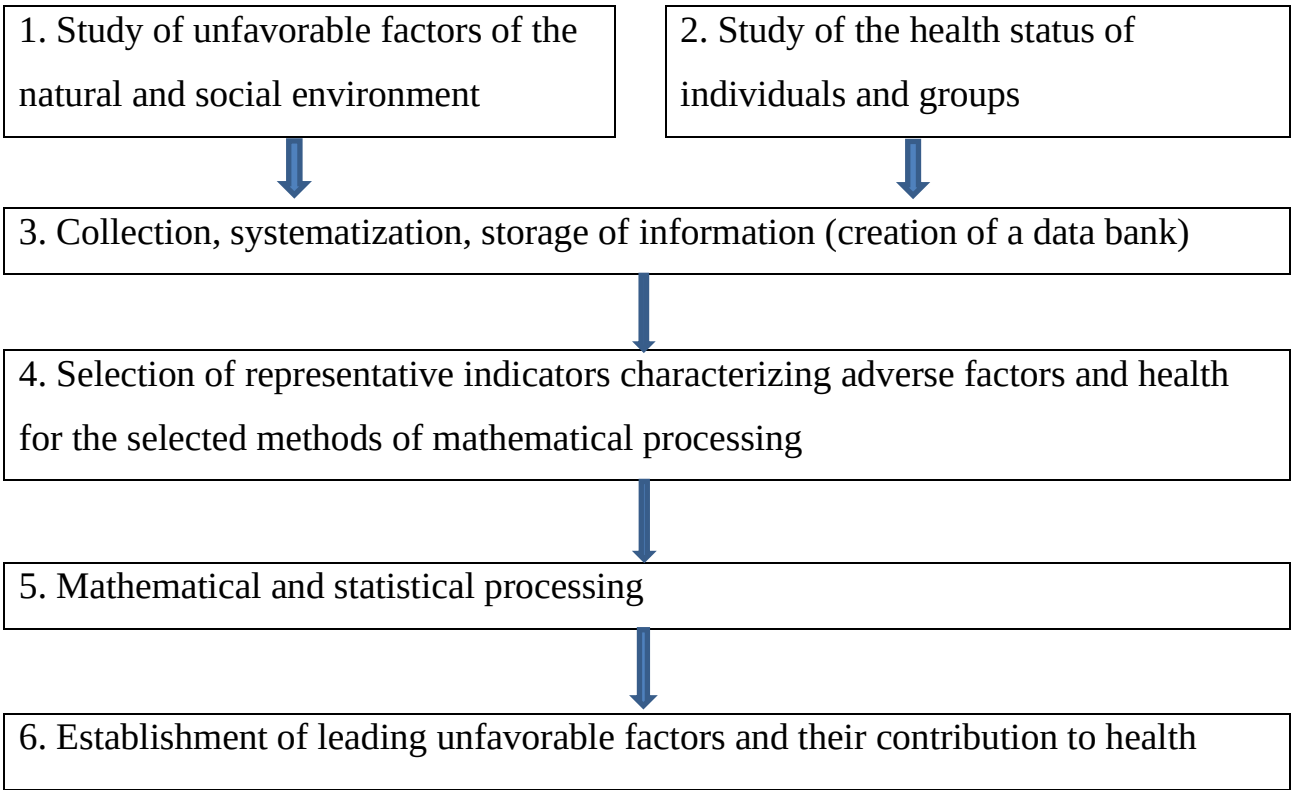
The task of hygienic diagnostics is to establish the causes of changes in human (population) health based on determining the contribution of various factors and identifying their sources, taking into account the professional and everyday activities of people in specific social and medical-geographical conditions. To preserve life and health, the doctor carries out hygienic diagnostics according to the following algorithm.

Risk factors for diseases (according to Lisitsyn Yu. P., 1987)

Spheres	Health value, approximate specific gravity, %	Group of factors
Lifestyle	49–53	Smoking. Unbalanced diet. Alcohol consumption. Harmful working conditions. Physical inactivity. Poor material and living conditions. Drug use. Drug abuse. Family fragility, loneliness. Low cultural level. Excessively high level of urbanization

Genetics, human biology	18–20	Predisposition to hereditary and degenerative diseases
External environment, natural and climatic conditions	17–20	Pollution of air, soil, water by carcinogens, etc. Sudden changes in atmospheric phenomena. Increased heliocosmic, magnetic and other radiations
Healthcare	8–10	Ineffectiveness of preventive measures, low quality and untimeliness of medical care

SCHEMATIC DIAGRAM OF HYGIENIC DIAGNOSTICS



GENERAL AND SPECIFIC CONCLUSIONS OF THE ANALYSIS

Hygienic diagnostics is a multi-stage process. It includes, first of all, a study of potentially harmful factors and the health status of military personnel, including direct and morbid indicators. High-quality collection of information requires the doctor to

have deep hygienic, physiological, clinical knowledge and skills in working with medical records.

Based on the data obtained, the doctor comes to conclusions about the relationship between the living conditions of military personnel and their health status. The conclusions contain information about the sources and causes of harmful factors, about unfavorable conditions and periods in the process of service activities, about critical groups of military personnel. Received the conclusions are the basis for developing proposals to the command to preserve and improve the health of personnel.

7. Principles of hygienic regulation

Hygienic regulation is carried out using sanitary and hygienic standards – these are the permissible levels of chemical compounds in environmental objects established by law and mandatory for all departments.

Hygienic standards are the levels of harmful production factors that, during daily work (40 hours per week) throughout the entire working period, should not cause diseases or health problems.

The hygienic regulation of chemicals is based on the following principles:

1) the principle of harmlessness – the effect of a substance on the human body is of paramount importance, and then the economic and technological benefits;

2) the principle of anticipation – the justification for the development of preventive measures for protection against a harmful substance must precede the moment of its introduction into production;

3) the principle of threshold action – i. e. reducing its concentrations to those that do not cause adverse changes (except for threshold mutagenic and carcinogenic ones, which have not yet been sufficiently studied);

4) the principle of unity of experimental and field research, i. e. on animals and people.

5) The principle of guarantee – hygienic standards, subject to their compliance, must guarantee the preservation of human health.

6) The principle of complexity – this principle involves taking into account the entire complex of possible adverse effects of the factor under study.

7) The principle of differentiation – depending on social situations (peacetime, wartime), several quantitative values or levels can be established for the same factor.

8) The principle of socio-biological balance – the hygienic standard of a harmful factor must be regulated taking into account the health benefits if it is observed, and the harm to health associated with the residual effect of the standard and the economic costs of complying with this standard. Priority is given to health indicators rather than economic benefits.

9) The principle of dynamism – the established hygienic standards are monitored in dynamics (for some time), the established limits of harmful factors are periodically clarified and, if necessary, changed.

Subject to the above principles, factor standards cannot be established in the form of a single value.

The parameters of a particular factor may have differentiated quantitative expressions, or levels that fit into a certain zone with maximum and minimum values.

Level I is optimal (comfort level), guaranteeing, when exposed to negative factors, the preservation of human health for an unlimited time of exposure.

Level II is acceptable, guaranteeing the preservation of a person's health and performance under the influence of negative factors for a certain period of time.

Level III is the maximum permissible level, at which a slight decrease in performance and a temporary deterioration in well-being are allowed.

Level IV – maximum} or extremely tolerable, allowing for a persistent decrease in health, performance, and failure of up to 10% of personnel. This is emergency and wartime level.

Level V – survival, designed for use in exceptional wartime cases.

Level VI – standardization of artificially formed environments. For example, standards for breathing oxygen-nitrogen or helium-oxygen mixtures replacing the normal atmosphere; standards for compensating suits and overalls for astronauts; excess pressure for the pilot's breathing in the event of depressurization of the aircraft cabin.

There are three types of normalization indicators: MPC, MPC, OBUV and ODU.

Hygienic standards are based on scientific research that substantiates the harmlessness of a certain concentration of a substance or level of physical impact on humans, as well as the level of their legislative approval for mandatory use in practice.

MAC – maximum acceptable concentration – is used for chemical substances when the effect of the compound has been studied, and the concentration of the substance in the workplace does not affect health or offspring; is legally approved by a government decree, therefore mandatory for all enterprises.

MAL – maximum acceptable level is the same for physical factors (for example, noise level, light, dust concentration on human skin, etc.)

TASE – when the effect of a substance has not been sufficiently studied and it is still being investigated, temporary approximate safe exposure levels are introduced.

AAL – for those that have been little studied and are not currently being studied – approximate acceptable levels.

Justification of temporary standards is carried out on the basis of accelerated experimental and computational methods (for TASE) or by analogy with already known substances (for AAL). Temporary standards are approved by the Chief State Sanitary Doctor of the Russian Federation and are not applied everywhere, but in specific industries. All hygienic standards, after approval, are part of the state sanitary and hygienic norms, rules and standards.

8. Prevention

Prevention is understood as a broad system of state, socio-economic and medical measures aimed at increasing the material ***well*** -being and cultural level of the population, improving living conditions, nutrition, labor activity, developing medical science, improving medical care, improving the activities of the sanitary and epidemiological service.

There are primary, secondary and tertiary prevention.

Main directions of prevention.

There is *a public one*, which includes a system of measures to protect the health of groups and *individual* prevention, which includes observing the rules of personal hygiene at home and at work.

Individual – includes measures to prevent diseases, preserve and improve health, which are carried out by the person himself, and practically comes down to compliance with the norms of a healthy lifestyle, personal hygiene, hygiene of marital and family relationships, hygiene of clothing, shoes, rational nutrition and drinking regime, hygienic education of the younger generation, a rational regime of work and rest, active physical education, etc.

Social – includes a system of social, economic, legislative, educational, sanitary, anti-epidemic and medical measures systematically carried out by state institutions and public organizations in order to ensure the comprehensive development of the physical and spiritual strength of citizens, and eliminate factors harmful to the health of the population.

Primary, or radical, prevention is aimed at eliminating the immediate cause of the disease. It can be carried out both with the help of hygienic regulation in the form of maximum acceptable concentrations (MAC), levels (MAL), and other standard values that reduce the impact of factors to safe levels. This prevention is also carried out through preventive sanitary supervision (at the design stage of the facility).

Secondary, or palliative, prevention is the early detection of pre-disease conditions through a thorough medical examination of practically healthy people who have been exposed to adverse environmental factors or risk factors, for drug prophylaxis and other measures to prevent the onset of the disease: therapeutic and preventive nutrition, personal protective equipment (PPE).

Tertiary prevention, or rehabilitation, is a set of measures to prevent the occurrence of complications of an already developed disease, carried out by attending physicians at the patient's bedside. Compared to the first two types of prevention, it is the least effective in reducing morbidity and mortality of the population.

LESSON 2

Measuring temperature (thermometry) and barometric pressure (barometry)

1. Hygienic value of air temperature

The temperature of the air surrounding a healthy and sick person as an environmental factor has a significant impact on a person's heat exchange, his performance and general well-being. Therefore, certain norms of temperature fluctuations have been established.

The most favorable air temperature in residential premises for a person who is at rest and usually dressed is a temperature of 16–18° C / for southern regions / and 18–20° C for northern regions with normal humidity of 40–60% and MOVEMENT speed air at 0.2–0.4 m/sec.

When performing physical work or when air speed or humidity changes, favorable temperatures will be different.

The air temperature above 24–25° C or below 14–15° C can disturb the thermal balance and can cause diseases. In addition, the air temperature in the room must be constant and uniform. Temperature fluctuations in the room during the day should not be more than 6° C, and with central heating – no more than 3° C. The temperature difference horizontally /from outer to inner walls/ should not exceed 2° C, and vertically /from floor to ceiling/ – 2,5° C.

The temperature factor is widely used in medicine: for example, in postoperative wards the temperature is maintained above average norms, and in preoperative wards – lower.

2. Temperature measurement technique

The indoor air temperature should be measured as follows:

a/ vertically – 10 cm from the floor; I m from the floor; 1.5 m from the floor; 0.5 m from the ceiling. When measuring temperature in a hospital room, the temperature must also be measured at a distance of 0.5 m from the floor.

b/ horizontally – 0.5 m from the outer and inner walls and in the middle of the room.

The choice of these points is due to the following: temperature 10 cm from the floor gives an idea of the air temperature at the level of the feet; I m from the floor – about the temperature of inhaled air while sitting; 1.5 m – about the temperature of inhaled air while standing; 0.5 m from the ceiling – the highest temperature in the room.

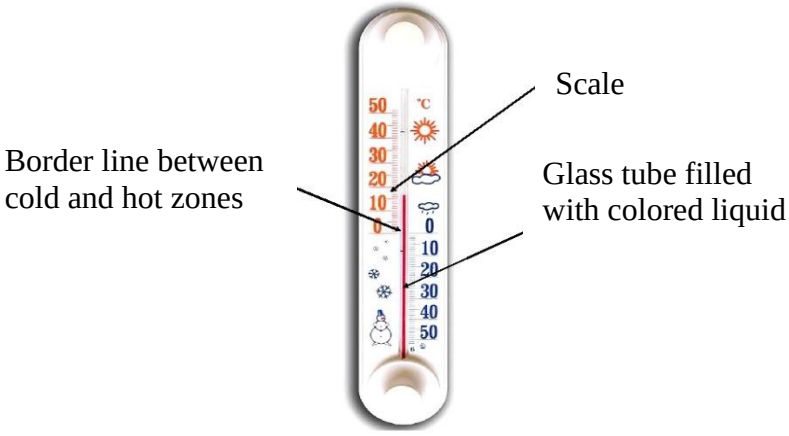
In a hospital, in a hospital ward, it is extremely important to measure the temperature at a level of 0.5 m, i. e., at the level of the patient lying on the bed. The temperature is measured diagonally in the room: in the corners and in the center, i. e. five horizontal determinations are made, but you can limit yourself to three.

Sanitary standards for the lower limits of temperature in outpatient rooms are essential, depending on the medical profile of patients: for a therapeutic room, the temperature should be within 18–20° C, because the patient has to undress.

3. Instruments for measuring temperature

Temperature is measured by various types of thermometers, which can be divided into two groups: liquid /mercury, alcohol/ and thermoelectric.

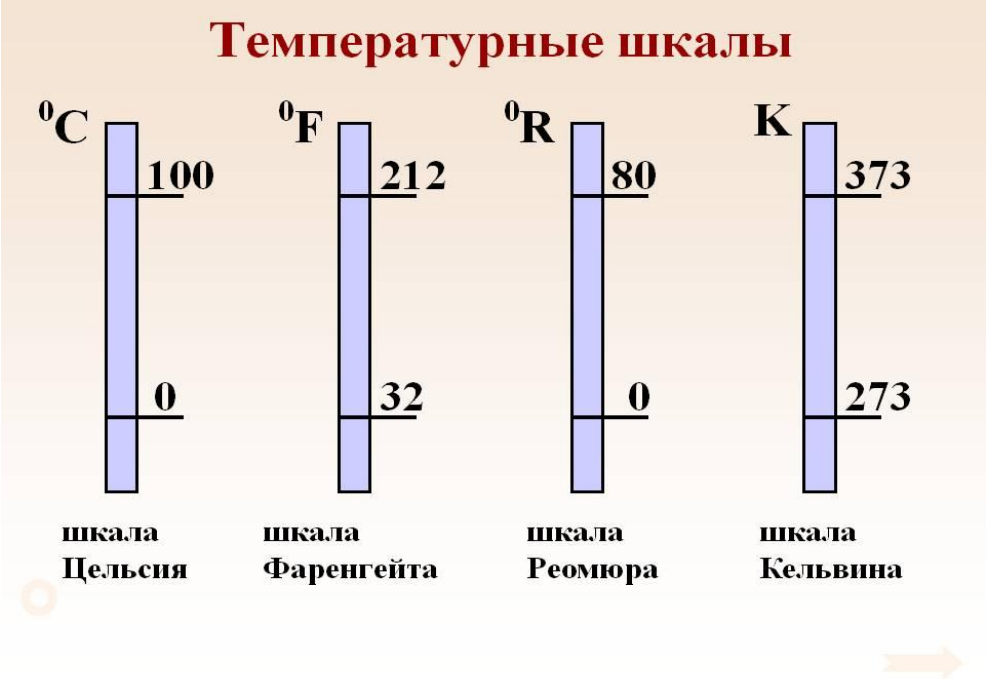
Structure of the thermometer



Liquid thermometers are based on the ability of liquids to expand when heated. The most widely used thermometers are alcohol thermometers (for measuring low and medium temperatures) and mercury thermometers. Mercury ones are more accurate

when determining high temperatures /from –35 to +3–7° C/. A liquid thermometer consists of a reservoir of liquid, a capillary, which is divided into divisions corresponding to degrees.

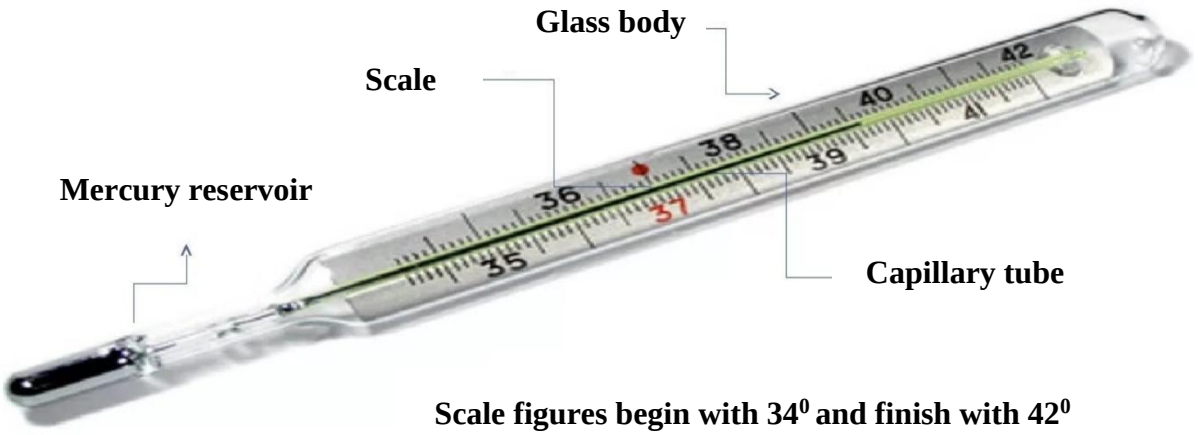
There are 4 types of temperature scales.



In the Russian Federation and most European countries, the Celsius scale is used.

The melting point of ice in distilled water is taken to be 0° C, and its boiling point at a pressure of 760 mm is taken to be 100° C. rt. Art.

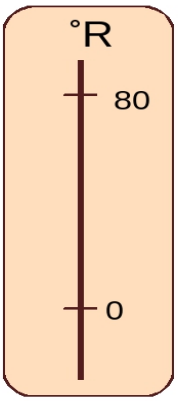
Mercury thermometer design



Scale figures begin with 34^0 and finish with 42^0

In France and French-speaking countries, the Reaumur scale / R / is common, where the boiling point of water is not 100, but 80 degrees Reaumur. The freezing point, just like Celsius, is zero. Unlike the Celsius scale, the Réaumur scale is divided into 80 divisions rather than 100.

Reaumur scale



boiling point of water
at normal pressure

ice melting point

In England, the USA, Australia and some other English-speaking countries, the Fahrenheit /F/ temperature scale is common, in which the freezing point of distilled water is +32, and its boiling point is +212, i. e. the entire capillary from the boiling point to the freezing point of distilled water is divided into 180 divisions.

Finally, there is the international Kelvin scale /K/, in which 0° is the temperature of absolute zero on the Celsius scale: –273°.

It is necessary to be able to convert temperature readings from one scale to another, because in foreign scientific periodicals, all 4 types of temperature measurement scales are found. This is done by drawing up and solving proportions.

EXAMPLE:

a) It is given that the patient's temperature was 37.0° C.

According to Reaumur: 80 refers to 100

X refers to 37

$$KEO = \frac{1500 \cdot 100\%}{95000} = 1,5\%$$

Fahrenheit: 180 refers to 100

X refers to 37

$$X = \frac{180 \cdot 37}{100} = 66,6 .....деленый$$

In order to get temperature degrees Fahrenheit, you need to add 32 to the resulting figure. We get: 66.6 + 32 = 98.6° F.

According to Kelvin: add 37 to 273 and get 310 K.

b) It is given that the patient's temperature is 98.6°F. What will it be equal to in Celsius, Reaumur?

First, we subtract 32 from 98.6, we get 66.6 divisions

Celsius: 100 refers to 180

X refers to 66.6

$$X = \frac{100 \cdot 66,6}{180} = 37^{o} C$$

According to Réaumur: 80 refers to 180

X refers to 66.6

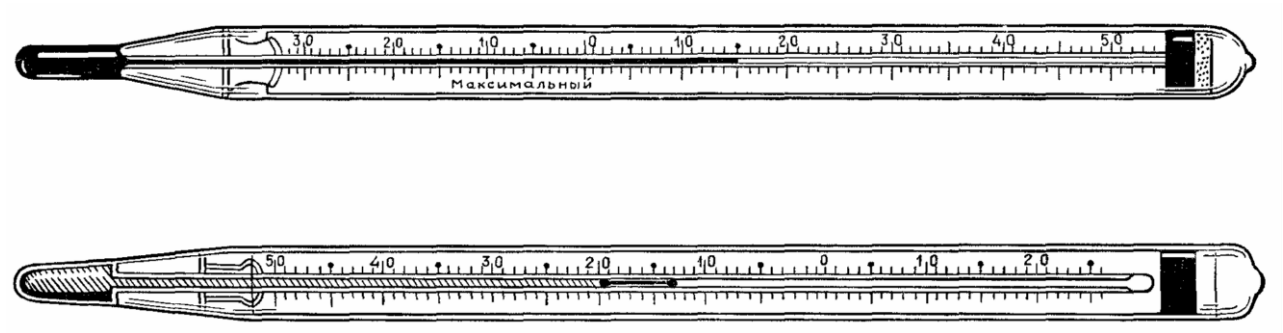
$$X = \frac{80 \cdot 66,6}{180} = 29,6^{o} R$$

Kelvin uses only degrees Celsius, i. e., 37° C.

For hygienic purposes, special thermometers are used:

Maximum thermometers – show the highest temperature that occurred during the study. For example, a medical thermometer. The essence of the maximum thermometer device is that At the junction of the mercury reservoir and the capillary, there is a narrowing that does not allow the mercury to fall, even if the temperature has already dropped.

Minimum thermometers – record the lowest temperature at research. The minimum thermometers are alcohol thermometers. Inside the capillary containing alcohol is a brightly colored float. When the temperature decreases, the float moves along with the alcohol, and when it increases, it remains in place.



Thermometers:

a – maximum (mercury); b – minimal (alcohol)

Thermoelectric thermometers have become widespread recently. The principle of their operation is based on fixing the thermoelectric potential that arises when the thermocouple heats up differently. These thermometers have a large accuracy and allow observation at a distance and in several places simultaneously.



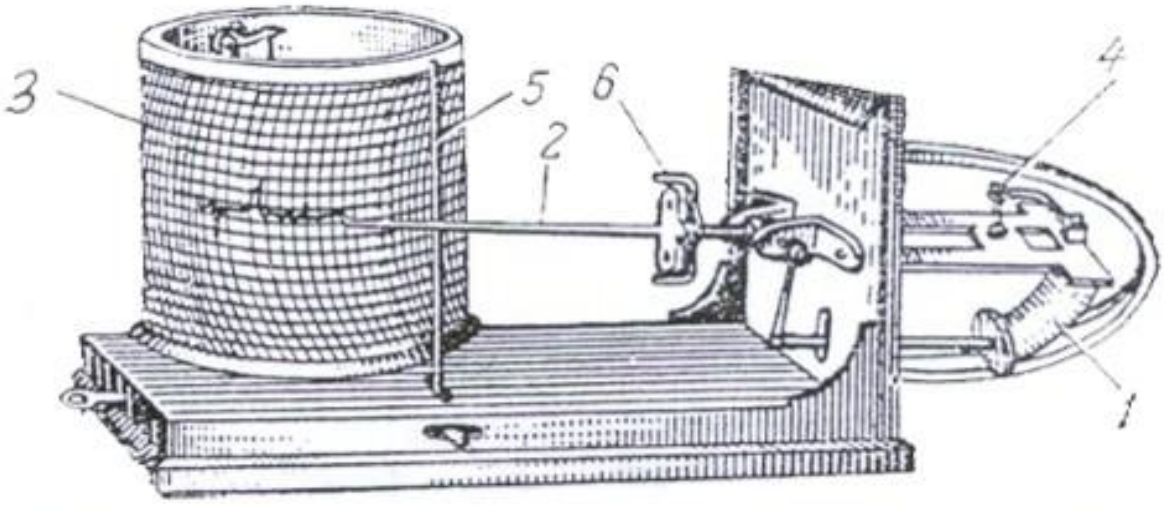
Richard's thermograph is a device designed to record temperature over time. Any temperature fluctuations are recorded graphically for the required period of time. The device consists of 2 parts – a receiving and recording device.

Thermograph



Thermograph diagram:

1. Bimetallic strip
2. Arrow with feather
3. Drum with clock mechanism
4. Adjustment screw
5. Graphic ribbon
6. Lever mechanism



4. Study of barometric pressure

Atmospheric or barometric pressure is a powerful environmental factor that, depending on various conditions, can have a significant impact on human health. Under natural conditions, an increase in pressure can lead to an improvement in the well-being of patients suffering from pulmonary insufficiency. A drop in atmospheric pressure can aggravate the course of the disease.

Atmospheric pressure is measured by devices that record the change in the height of the mercury column in millimeters. Normal atmospheric pressure is considered to be 760 mmHg. Determination is carried out using mercury barometers. Currently, aneroid barometers and altimeters are used, where changes in atmospheric pressure are determined by the compression force of a vacuum chamber.

For continuous monitoring of atmospheric pressure fluctuations, recording instruments are used – Richard barographs with a weekly factory.

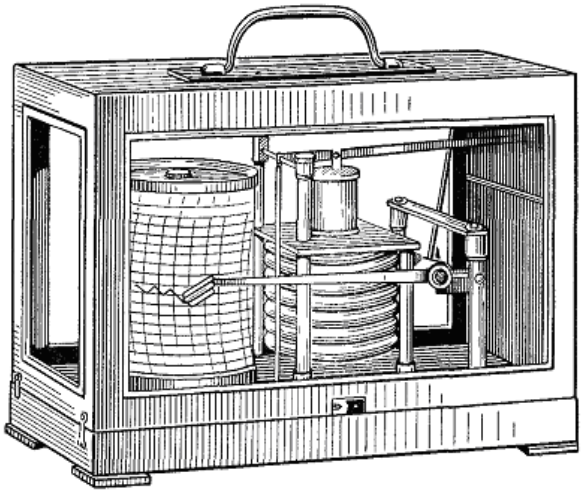
Currently, barometric pressure is expressed in international units – hectopascals / g Pa /. I g P a is the pressure exerted by a body weighing I g per 1 square meter. cm surface. 1 g Pa is equal to 0.7501 mm p column. To recalculate the pressure value expressed in mmHg. column in hectopascals, you need to multiply the existing value by 4/3.

Aneroid barometer

1 Corps
2. Corrugated box
3. Glass
4. Scale
5. Metal plate
6. Arrow



Barograph

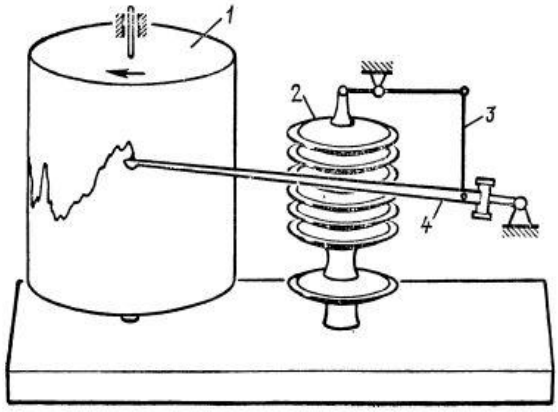


Barograph

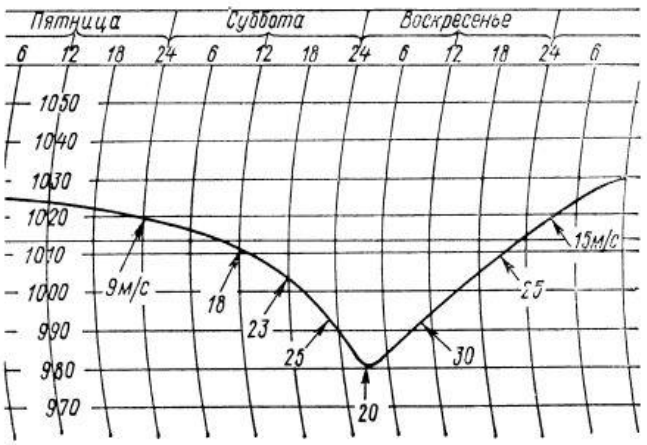
1) barrel with clock mechanism, 2) bellows, 3) lever, 4) pen recorder

Схема барографа.

1 — барабан с часовым механизмом; *2* — сильфон; *3* — рычаг; *4* — перо самописца.



Барограмма.



Independent work

Students determine the temperature in the classroom before and after classes and express the data obtained in degrees Celsius, Reaumur, Fahrenheit and Kelvin. Barometric pressure is measured and expressed in mmHg. column and in Pa. Based on the data obtained, a sanitary conclusion is made about the temperature regime and its changes during the practical lesson. All data and conclusions are documented in the form of a sanitary examination protocol and presented to the teacher at the end of the lesson.

PROTOCOL

research and assessment of the air temperature regime

in _____

(Object name)

1. Study date _____ time _____

2. The study was carried out with a mercury thermometer _____

3. Vertical temperature measurement

10 cm from the floor _____ ^{0}C

0.5 m from the floor _____ ^{0}C

1m from the floor _____ ^{0}C

1.5 m from the floor _____ ^{0}C

0.5 m from the ceiling _____ ^{0}C

temperature difference _____ ^{0}C

4. Horizontal temperature measurement

0.5 m from the outer wall _____ ^{0}C

0.5m from the inner wall _____ ^{0}C

in the middle of the room _____ ^{0}C

temperature difference _____ ^{0}C

5. Temperature conversion: _____

_____

_____

6. Conclusion on the temperature conditions in the examined room:

_____

_____

_____

_____

_____

_____

_____

The study was conducted by (signature) _____

Teacher's signature _____

TEST CONTROL

1. Microclimate is:

а) a natural sequence of meteorological processes, identifying the long-term weather patterns in a given area;

б) combination of meteorological conditions indoors;

в) combination of meteorological conditions in the surface layer small areas of the earth's surface;

г) set of meteorological conditions at a specific location at this time.

2. The main factors affecting humans in mountain climates are:

а) increased atmospheric pressure

б) reduced t – air temperature

в) increased UV radiation

г) decreased partial pressure of oxygen

3. The process of acclimatization in humans depends on:

а) health conditions

б) gender

в) age

г) physical training

4. The complex of elements that make up the weather:

а) solar radiation

б) terrain

в) physical properties of air (t – pa, relative humidity, atmospheric pressure, etc.)

г) wind direction and speed

д) geographic latitude and longitude

5. A cyclone is characterized by:

а) increased relative humidity

б) low atmospheric pressure

в) reduced t – ra in the center of the cyclone

г) cloudy, drizzling

д) increased t – ra in the center of the cyclone

6. An anticyclone is characterized by:

а) low relative humidity

б) increased atmospheric pressure

в) increase in t – ry in the center of the anticyclone

г) clear, dry weather

7. Natural environmental factors:

а) factors depending on human economic activity

б) factors beyond a person's control

в) factors that protect health

8. What is a “Hygiene Diagnosis”?

а) there is no such concept in medicine

б) comparative assessment of the number of hygiene factors and hygiene standards

в) exceeding the actual number of safe hygiene factors

г) standards

д) compliance of the number of hygienic factors and hygienic standards

9. Biotic environmental factors:

а) human related

б) related to human health

в) living factors

г) not related to humans

10. Abiotic environmental factors:

а) microorganisms, viruses, protozoa, helminths

б) non-living

в) living and nonliving together

г) non-living factors that pose a health hazard

11. Human ecology exists:

а) statistical

б) preventive

в) synecological

12. Thermoregulation is:

а) increase in body temperature under the influence of external factors;

б) decrease in body temperature under the influence of external factors;

в) maintaining a constant body temperature using physiological mechanisms of heat production and heat transfer;

г) temperature change under the influence of internal factors.

13. At normal (room) temperatures, the main heat loss occurs through:

а) skin

б) lungs

в) warming water and food

г) sebaceous glands

д) urinary organs

14. To ensure human thermal comfort in a room, the following are of great importance:

а) air temperature;

б) air temperature and the magnitude of temperature differences horizontally and vertically in the room;

в) air temperature and the magnitude of temperature differences across;

г) horizontal and vertical levels of the room, temperature of the internal surfaces of the walls;

д) temperature of external wall surfaces.

15. The permissible difference t – p of air in a residential area horizontally is:

а) 1 C

б) 2 C

в) 3 C

г) 4C

д) 6 C

16. To measure high t -p use _____ thermometer:

а) mercury

б) alcoholic

в) maximum

г) minimum

17. Temperatures below – 39^0 C are measured by thermometers:

а) mercury

б) alcohol

в) maximum

г) minimal

д) maximum – minimum

18. Maximum thermometers:

а) mercury

б) alcohol

в) thermoelectric

г) "normal"

19. A medical thermometer for measuring human body temperature is designed:

а) maximum

б) minimal

в) "normal"

г) thermoelectric

д) maximum – minimum

20. Minimum thermometers:

а) mercury

б) alcohol

в) thermoelectric

г) "normal"

21. Thermometer is used as a standard:

а) maximum

б) minimum

в) "normal"

г) thermoelectric

д) maximum – minimum

22. To dynamically monitor the t – swarm of air in a room, use:

а) hygrograph

б) barograph

в) thermograph

г) catathermometer

д) anemometer

23. The body system is most sensitive to microclimate changes:

а) respiratory system

б) thermoregulation

в) digestion

г) nervous system

д) cardiovascular

24. Green spaces on the territory of the microdistrict contribute to:

а) lower humidity

б) temperature rise

в) increase in humidity

г) temperature drops

25. Climate-forming factors are:

а) geographic longitude and latitude

б) terrain

в) ionic composition of the atmosphere

г) atmospheric circulation

д) human activity

26. Causes causing climate change:

а) increase in carbon dioxide content and other "greenhouse" gases of the atmosphere;

б) increase in energy production;

в) computerization of all types of human activity;

г) air pollution by various solid and liquid particles.

27. The climate of the area affects:

а) processes of dispersion of emissions into atmospheric air

б) effectiveness of biological methods neutralization of wastewater and solid waste

в) epidemiology of natural focal diseases

г) intensity of metabolic biochemical processes in the human body

д) human heat exchange

28. According to the medical classification of climate, the following types are distinguished:

а) nautical
б) cold
в) moderate
г) continental
д) hot

29. He speaks about the ongoing acclimatization of a person:

а) performance
б) mental and physical health
в) ability to produce viable offspring
г) duration of the initial stage of acclimatization

30. Human acclimatization in the North is facilitated by:

а) increasing the calorie content of the daily diet
б) reducing the amount of fat in the daily diet
в) increasing the amount of carbohydrates in the daily diet
г) increasing the number of proteins and fats in the daily diet

31. For successful acclimatization of a person in a hot climate it is necessary:

а) increasing the amount of proteins and fats in the daily diet
б) increasing the amount of carbohydrates in the daily diet
в) increasing the amount of mineral salts and vitamins
г) the layout of neighborhoods should be as disaggregated as possible
д) maintaining personal hygiene rules

32. Secondary prevention is:

а) a set of medical measures aimed at early detection and prevention of exacerbations, complications and chronicity of diseases;

б) a set of social measures aimed at early detection and prevention of exacerbations, complications and chronicity of diseases;

в) a set of medical, sanitary, hygienic and psychological measures aimed at early detection and prevention of exacerbations, complications and chronicity of diseases;

г) a set of medical, social, sanitary-hygienic, psychological and other measures aimed at early detection and prevention of exacerbations, complications and chronicity of diseases.

33. They became the founders of experimental hygiene:

а) M. Pettenkofer

б) E. Parks

в) A. P. Dobroslavin

г) F. F. Erisman

LESSON 3

The importance of air humidity as a hygienic factor. Determination of air humidity (psychrometry and hygrometry)

1. Hygienic and environmental significance of air humidity

As a natural environmental factor, air humidity in combination with other meteorological parameters has a significant impact on the heat exchange of the human body and, consequently, on his well-being.

Sources of water vapor in atmosphere: vaporization from the surfaces of the oceans, seas, water reservoirs, moist soil, plants. Depending on the amount of vapor in the atmosphere air can be dry and humid. Humid air contains water vapors.

Depending on humidity and air temperature, heat transfer may increase or decrease. The most unfavorable for humans are the following combinations of meteorological factors:

a) low temperature, high humidity, intense movement of air masses /strong wind/ – this combination can lead to hypothermia and even frostbite of parts of the body or the entire body;

b) high temperature, high humidity, lack of air movement – this combination can lead to overheating of the human body and even heat stroke;

v) high temperature, low humidity, strong wind – this combination of weather factors can lead to rapid dehydration of the body.

Air humidity depends on temperature, measured by hygrometer, can be maximum (max water vapor at given t^0. Absolute – actual water vapor at this moment. Relative – ratio of absolute humidity to maximal, in %.

At the 30^0 C 1 m^3 of air produces 20 gram of water vapor. $+20^0$ C – 17 g, $+10^0$ C – 9 g, -10^0 C – 2,5 g.

To characterize air humidity, the following values are used:

a) absolute humidity is the saturation of air with water vapor under given conditions, in a given place, at a given time. Measured in grams of water vapor in 1 cubic meter of air;

b) ***<u>maximum humidity</u>*** is the amount of water vapor that could maximally saturate the air under given conditions. For the same conditions, this value is constant. It is measured in grams of water vapor in 1 cubic meter of air;

v) ***<u>relative humidity</u>*** is the ratio of absolute humidity to maximum humidity, expressed as a percentage. Relative humidity as a hygienic indicator of microclimate has become widespread. Relative humidity is considered optimal WITHIN 40–60%;

d) ***<u>saturation deficit</u>*** – the difference between maximum and absolute humidity.

e) ***<u>dew point</u>*** – the temperature at which water vapor in the air saturates the space.

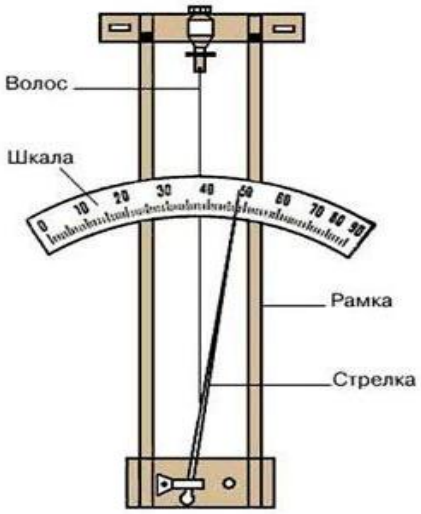
2. ***<u>Method for determining air humidity</u>***

a) ***The hygrometric method*** for determining humidity is based on the property of defatted and depigmented human hair to change its length DEPENDING on the humidity of the surrounding air. This method is used in the Koppe hygrometer and Richard hygrograph. <u>Relative humidity</u> is determined, which is immediately expressed in percent.

more than 80%	Extremely high level of humidity
70–75%	High
60–65%	Increased
40–55%	Optimal
30–40%	Low
20%	Extremely low

<u>Hygrometer</u>

Hair Scale Frame Arrow





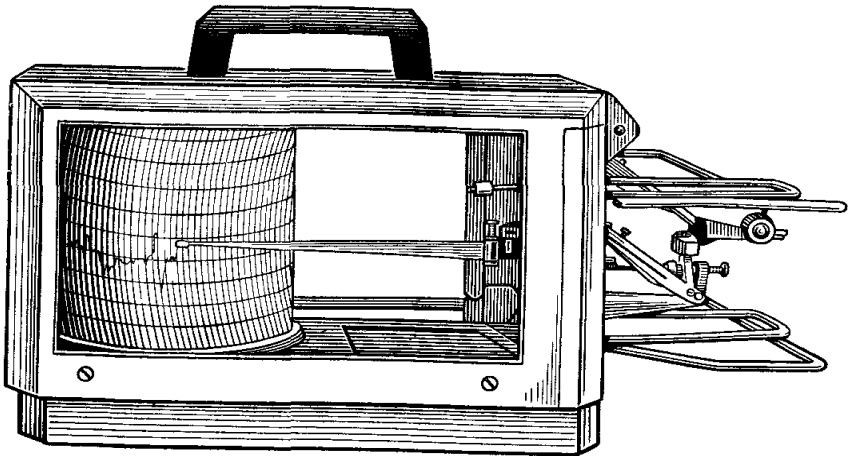
1) Hair
2) Bracing
3) Roller
4) Load
5) Arrow

Hair hygrograph:

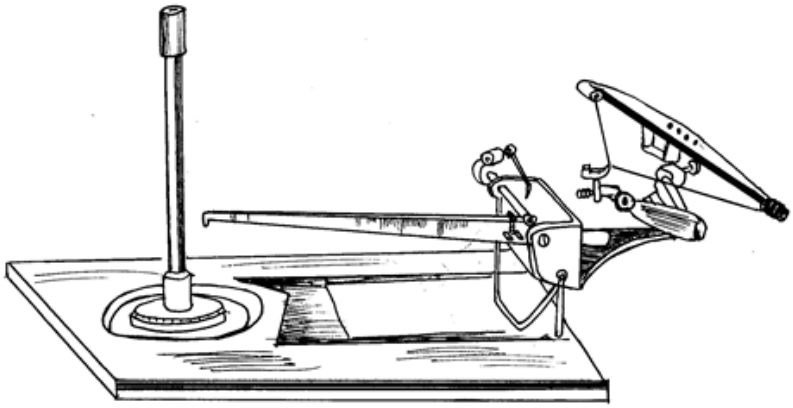
a) general view;

b) recording part, transmission mechanism.

a)



b)



b) The psychrometric method of determining humidity is based on the fact that, depending on the saturation of the air with water vapor, evaporation from the surface of any body occurs unevenly. During evaporation, a certain amount of heat is given off and, therefore, the lower the humidity of the surrounding air, the more water will evaporate from the surface, the more heat will be given off.

3. *Instruments for determining air humidity*

Air humidity is determined by August and Assmann psychrometers.

The principle of the method is based on measuring the difference in the readings of dry and wet thermometers. The greater the temperature difference, the lower the relative humidity.

a) ***August's psychrometer*** consists of two thermometers, a reservoir, one of which is wrapped in hygroscopic matter. Before determination, this matter is moistened with distilled water. To determine air humidity with the August psychrometer, the device should be installed at a level of 1.5 m from the floor and observations should be made for 10–15 minutes. Then the readings are taken from the dry and wet thermometers. Absolute humidity is determined by a psychrometer. When using the August psychrometer, absolute humidity is calculated using Regnault's formula.

$$K = F - d\,(T_1 - T_2)\,V$$

where K – absolute humidity;

F – maximum humidity at wet-bulb temperature, found from tables;

e – psychrometric coefficient, depending on the speed of air movement. For rooms without drafts, it is equal to – 0.0011;

T_1 and T_2 – dry temperature / T_1 / and T wet bulbs;

V is the barometric pressure at the time of the study IN mmHg.

upper spare thermometer tank	psychometric table
“dry” thermometer	"wet" thermometer
scale thermometer	plastic thermometer
filter	feeder
lower main thermometer tank	distilled water

b) The ***Assmann psychrometer*** also consists of two thermometers, but it has a number of advantages over the August psychrometer. The Assmann psychrometer is more accurate because it has a protective casing that prevents the thermometers from being exposed to solar and other radiant energy; has a forced ventilation system that allows you to ignore drafts.

To determine absolute humidity with a chromemeter Assmann uses the Sprung formula:

$$K = \Phi - 0,5 / T_1 - T_2 / \cdot \frac{B}{755}$$

where the letter designations are the same as in the previous formula. Value 0.5 – constant coefficient; 755 – average atmospheric pressure.

Relative humidity is determined by the formula:

$$P = \frac{K}{\Phi} \cdot 100$$

where P is relative humidity, expressed as a percentage;

K is the absolute humidity found by us;

Φ – maximum humidity at dry bulb temperature, i. e. at the air temperature at the time of the study. Find it from the table.

To quickly determine relative humidity using psychrometers, there are special tables in which the relative humidity can be immediately found based on the difference in readings between dry and wet thermometers.

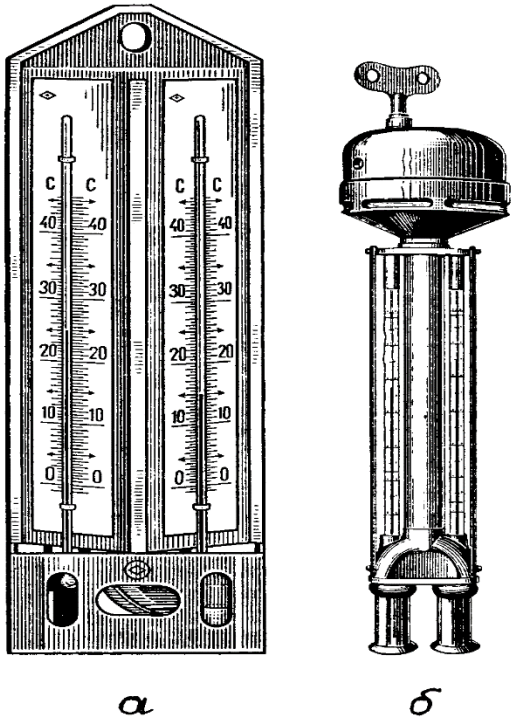


Fig: a – August psychrometer; b – Assmann psychrometer

Table 1. Maximum air humidity at different temperatures

Temperature	Water vapor pressure in mm Hg. Art.	Weight of water vapor saturating the air, g / m	Temperature	Water vapor pressure in mm Hg. Art.	Weight of water vapor saturating the air, g / m
–5	3.113	3.360	16	13.530	13.552
–4	3.387	3.614	17	14.421	14.391
–3	3.662	3.902	18	15.357	15.329
–2	3.995	4.194	19	16.364	16.203
–1	4.267	4.522	20	17.391	17.164
0	4.600	4.874	21	18.495	18.204
1	4.940	5.210	22	19.659	19.284
2	5.302	5.574	23	20.888	20.450
3	5.687	5.963	24	22.184	21.604
4	6.097	6.370	25	23.550	22.867
5	6.534	6.791	26	24.988	24.190
6	6.998	7.260	27	26.505	25.582
7	7.492	7.734	28	28.101	27.004
8	8.017	8.252	29	29.782	28.529
9	8.574	8.713	thirty	31.584	30.139
10	9.165	9.372	31	33.406	31.890
eleven	9.792	9.976	32	35.359	33.640
12	10.457	10.617	33	37.411	35.480
13	11.162	11.284	34	39.565	37.400
14	11.908	12.018	35	41.827	39.410
15	12.699	12.763	36	44.201	41.510
			37	46.691	43.710

Individual work

Students carry out humidity determinations using August and Assmann psychrometers in the student auditorium /at various points/, at the beginning and at the end of the lesson; on the street. The obtained data is analyzed. The research is documented in the form of a sanitary research protocol and is presented to the teacher at the end of the lesson.

RECORD

research and assessment of relative air humidity

_____

(Object name)

1. Date of research _____time _____hour_____

2. The study was carried out **by the August psychrometer**

3. Dry bulb readings _____ ^{0} C

value according to table No. 1 _____

4. Wet bulb readings _____ ^{0} C

value according to table No. 1_____

5. Renu formula_____

6. Humidity calculation according to the table:

_____

_____

_____

_____

_____

_____

Absolute humidity_____

7. The study was carried out with an **Assmann psychrometer**

8. Dry bulb readings _____ ^{0} C

value according to table No. 1_____

9. Wet thermometer readings _____ ^{0} C

value according to table No. 1_____

10. Sprung Formula_____

11. Calculation of humidity according to the table:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Absolute humidity_____

12. Determination of relative humidity _____

_____

_____

_____

_____

_____

Conclusion on the humidity conditions in the examined room:

_____

_____

_____

_____

_____

_____

_____

The study was conducted by (a) (signature)

_____

Teacher's signature _____

TEST

1. To ensure favorable conditions for the thermoregulation system at low air temperature in the room, it is necessary to create:

а) low humidity and high air movement
б) low humidity and low air movement
в) high humidity and high air movement
г) high humidity and low air movement

2. High air temperature is transferred easier:

а) in dry air
б) in humid air
в) at high pressure
г) at low pressure

3. Under conditions of low t-p, a person loses more heat:

а) in dry air
б) in humid air
в) at low air mobility
г) at high air mobility

4. Microclimatic conditions close to optimal in residential premises are created at air temperature and relative humidity:

а) 23 C and 65%
б) 23 C and 25%
в) 21C and 45%
г) 18 C and 60%
д) 26 C and 78%

5. To dynamically monitor the relative humidity in the room, use:

а) catathermometer
б) August psychrometer
в) hygrograph
г) barograph
д) Janiszewski's pyranometer

6. Hygienic standard for relative humidity in residential premises:

а) 20–40%
б) 30–60%
в) more
г) less

7. To determine indoor air humidity indicators, use:

а) thermograph
б) catathermometer
в) hot-wire anemometer
г) anemometer
д) psychrometer

8. Absolute humidity is:

а) elasticity of water vapor currently in the air at a given t – re
б) elasticity of water vapor in a state of complete saturation of air with it
в) percentage saturation of the room with vapors at the time of observation

9. Absolute humidity gives an idea of:

а) water vapor content in the air
б) degree of air moisture saturation
в) lack of saturation

10. Maximum humidity is:

а) pressure of water vapor currently in the air

б) elasticity of water vapor in a state of complete saturation of air with it

в) percentage saturation of the room with water vapor at the time of observation

г) ratio of absolute humidity to maximum

11. Relative humidity is:

а) pressure of water vapor currently in the air;

б) elasticity of water vapor in a state of complete saturation of air with it;

в) percentage ratio of the actual elasticity of water vapor in the air to the maximum possible air humidity at a given temperature;

г) ratio of absolute humidity to maximum.

12. Relative humidity is measured:

а) mmhg

б) kPa

в) %

г) μ /cm /sec

д) m/sec

13. Air humidity is normalized:

а) absolute

б) maximum

в) relative

г) minimum

14. Of greatest hygienic importance are:

а) absolute and maximum humidity

б) maximum and relative humidity

в) relative humidity and saturation deficit;

15. A more accurate device for determining humidity:

а) Augusta
б) Assmann psychrometer
в) hygrometer
г) hygrograph

16. Protection against the influence of infrared radiation and random air movement is available:

а) in the Assmann psychrometer
б) in August's psychrometer
в) in a hygrometer
г) in a hygrograph

17. Of greatest hygienic importance are:

а) absolute and maximum humidity
б) maximum and relative humidity
в) relative humidity and saturation deficit;

18. The microclimate of the premises is characterized by a set of indicators:

а) Temperature, humidity and air speed.
б) Barometric pressure and temperature.
в) Temperature of surrounding surfaces.
г) Chemical composition of air.
д) High humidity and temperature

LESSON 4

Determination of movement speed (anemometry) and cooling properties of air (catathermometry)

1. The importance of air speed as a natural environmental factor

Due to the movement of air masses in natural conditions, above any point on the earth's surface maintains approximately the same chemical composition of the atmosphere.

This is an extremely positive environmental factor, since thanks to it the amount of oxygen is the same over large industrial regions and over forests.

Air movement /wind/ has a significant impact on a person's health and well-being. In hot weather, the wind improves the transfer of heat, bringing relief /unless, of course, it itself is hot and dry/; in cold weather, on the contrary, increasing heat transfer aggravates the unfavorable effect of low temperature.

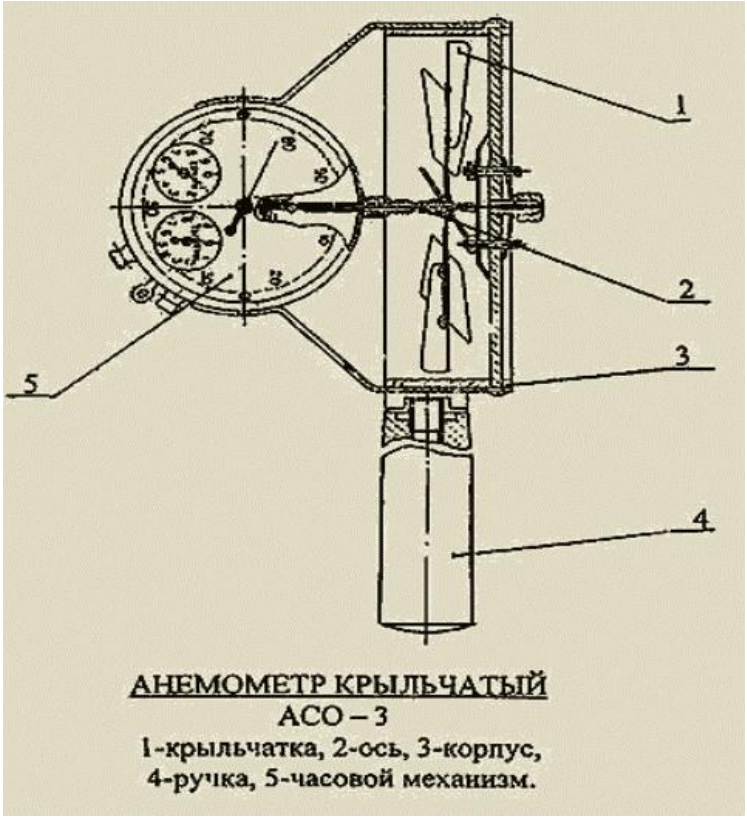
In many cases, intense movement of air masses is associated with a sharp change in weather, the passage of a weather front, cyclones, and anticyclones.

The above-mentioned phenomena in the atmosphere can adversely affect humans, causing an independent nosological form of diseases – meteopathies. Children, sick and elderly people are especially sensitive to sharply changing weather factors.

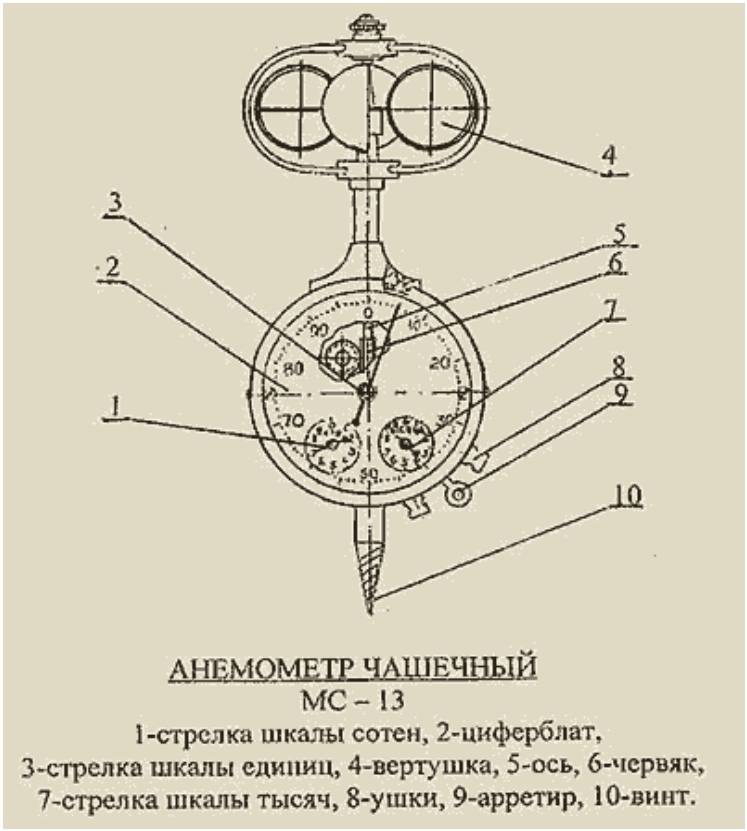
Air movement, based on the "Classification of types of reaction of the human body to the influence of environmental factors" /J. G. Khachirov/, can cause any response, up to changes incompatible with life in the human body.

2. Methods for determining air speed

The speed of air movement is determined by anemometers, which can be dynamic /cup and wing/ and static.



Winged Anemometer ACO – 3: 1) impeller 2) axis body 3) handle 4) clockwork



Cup anemometer: 1) hundreds scale arrow; 2) dial; 3) units scale arrow;

4) spinner axis; 5) worm; 6) thousands scale arrow; 7) lugs; 8) arrestor; 9) screw

The speed of air movement is expressed in meters per second, as well as in points on the 12-point Beaufort scale, which gives a relative assessment of the speed of air movement in points and the corresponding expression in m/sec.

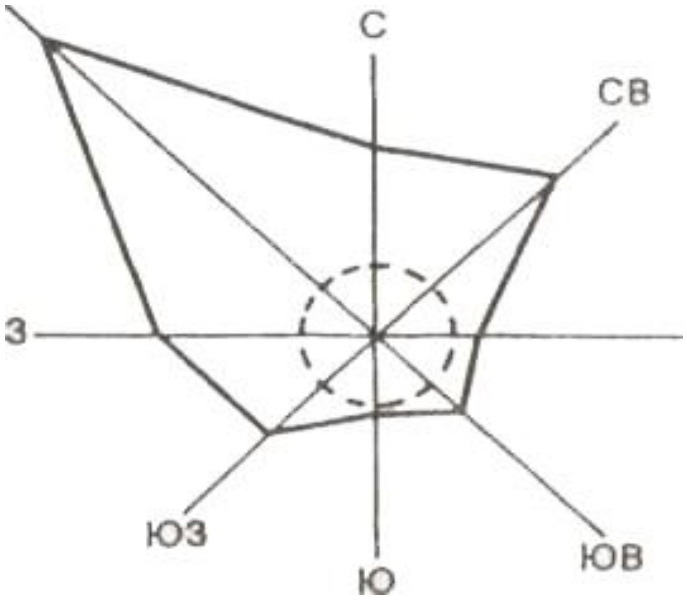
To indicate the recurrence of winds and their direction, there is a graphic image called **“wind roses”**.

Methodology for determining the “wind rose”.

The direction of the wind is understood as the side of the horizon from which the wind blows; it is marked with 16 points (main and intermediate).

The annual frequency of winds in a particular area is displayed graphically in the form of a “wind rose”. To construct a “wind rose”, the frequency of winds in each direction, expressed as a percentage, is plotted on the rhumb chart and connected by a broken line. Calm days are marked with a circle with a radius corresponding to the percentage of calm days.

Permissible air movement values for residential premises, hospital wards and clinic offices are considered to be 0.2–0.4 m/sec.



С – North, СВ – NE

Ю – South, ЮВ – SE

З – West, ЮЗ – SW

3. Assessing indoor ventilation or determining the air exchange rate

Ventilation refers to the exchange between clean air outside and air inside a room. Ventilation can be artificial / supply or exhaust / and natural.

The ratio of the amount of air supplied or extracted from a room within an hour to the volume of air in the room is called **the exchange rate** for a given room.

The air exchange rate is determined by the formula:

$$K = \frac{A}{B}$$

where K is the air exchange rate;

A – the amount of air pumped or extracted from the room during I hour;

B – cubic capacity of the room.

The amount of air entering or exiting is determined by multiplying the area of the ventilation opening by the air speed. The speed of air movement is determined by dynamic anemometers.

EXAMPLE: The volume of the room is 75 cubic meters. The size of the window through which ventilation occurs is 0.4 x 0.25 m. The air movement according to the readings of a dynamic anemometer in 3 minutes is on average 65 m/min. If we conventionally assume that air leaves the room through one half of the window and enters through the second, we get that 0.4 x 0.25:2 x 65 x 60 = 195 cubic meters enter the room per hour. m. This means that in 60 minutes or an hour 195:75 = 2.6 times the air exchange occurs. Under normal indoor conditions, exchanges of at least 1.5 times per hour are considered optimal.

4. Determination of the cooling properties of air and the speed of air movement according to the readings of a catathermometer

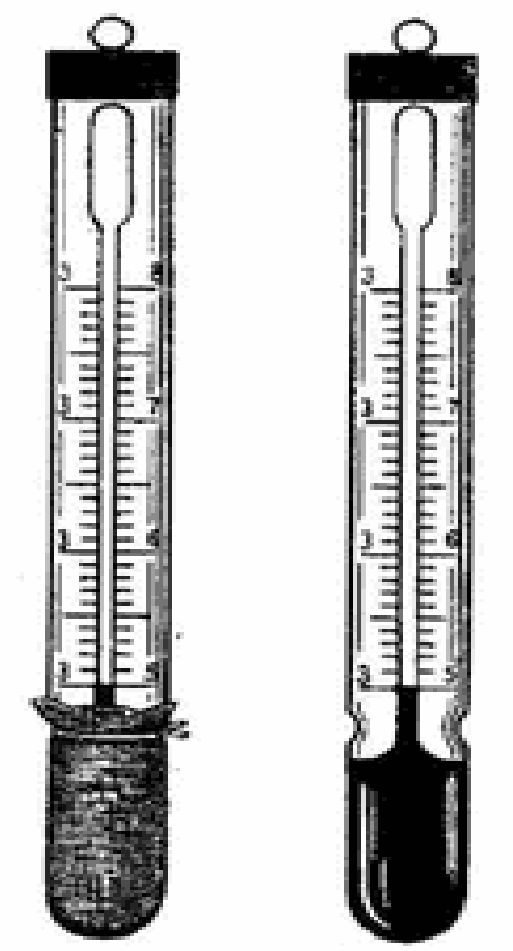
Catathermometry /determination of falling temperature/ is used to determine the complex impact of meteorological or microclimatic factors on a person.

The cooling properties of air depend on temperature, humidity, movement of air masses, and barometric pressure. Depending on the listed factors and their parameters, the cooling properties can vary within significant limits.

There are two types of catathermometers.

Hill's catathermometer is a device proposed in 1922 by the Englishman Hill to determine the rate of temperature drop or cooling properties of air.

Cylindrical catathermometer.



The device has a cylindrical reservoir, which is filled with colored alcohol. There is a small container at the top of the device. The scale is divided into degrees Celsius from 38 to 35. The middle of the scale corresponds to the average human skin temperature – 36.5° C. Each catathermometer has its own individual factor, depending on different glass thicknesses and other features. The catathermometer factor is introduced into the calculations so that determinations by different instruments under identical / identical / conditions produce the same results.

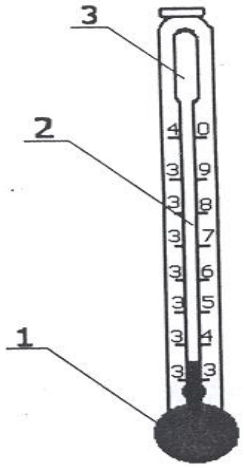
The ball catathermometer was developed by the Leningrad Institute of Labor and Occupational Diseases and is more advanced.

Ball catathermometer:

1 – lower reservoir;

2 – instrument scale;

3 – upper reservoir



The catathermometer scale is divided into degrees Celsius from 40 to 33. The reservoir has a spherical shape, which makes heat transfer more uniform. The middle of the scale, as in the Hill catathermometer, is 36.5° C. Ball catathermometers also like Hill catathermometers, they have a factor that is individual for each device.

a) Method for determining the cooling properties of air.

The catathermometer is lowered into a vessel with hot water /75–80° C/ and held until the alcohol rises and fills half of the upper tank. After this, the catathermometer is removed, wiped thoroughly dry and hung on a tripod. Using a stopwatch, they monitor the temperature drop and record the time of the fall: in the Hill catathermometer from 38 to 35° C, in the ball thermometer from 40 to 33° C.

Cooling properties are calculated using formulas.

For Hill's catathermometer

$$H = \frac{\Phi}{T}$$

For a ball catathermometer:

where H is the magnitude of the cooling properties,

F is the catathermometer factor engraved on the device,

$$H = \frac{\Phi : 3 / Q_1 - Q\ /}{T}$$

T – time of temperature drop,

Q_1 – upper limit of the scale for a ball catathermometer – 40° C,

Q_2 – the lower limit of the scale for the ball catathermometer is 33° C.

Optimal well-being in persons engaged primarily in mental work in normal clothing and in patients ranges from 5.5 to 7.0.

The cooling properties of air are measured in millicalories of heat, which is given off in 1 second of 1 square. see body surfaces. If the indicator is more than 7, then the person is freezing; if less than 5, he will be hot.

b) <u>Method for determining air speed using catathermometer readings.</u>

Micropulsations and low air velocity can be determined by the readings of a catathermometer. Catathermometers determine micropulsations of air movement, which cannot be determined with anemometers.

To calculate air speed less than I m/sec. use the following formula:

$$B = \left(\frac{\frac{H}{Q} - 0,13}{0,47} \right)^2 ; \; B = \left(\frac{\frac{H}{Q} - 0,20}{0,40} \right)^2 .$$

To calculate air speed more than 1 m/sec. use another formula:

where B is the desired air speed;

N is the magnitude of the cooling properties;

Q is the difference between the average human body temperature /36.5° C/ and the ambient air temperature at the time of the study;

0.20; 0.40; 0.13; 0.47; – empirical coefficients.

CALCULATION EXAMPLE: Air speed less than I m/sec. The cooling properties of air according to the catathermometer data are 5.5. Air temperature 20° C. We substitute the data into the first formula and get:

$$B = \left(\frac{5,5 : 16,5 - 0,20}{0,40} \right)^2 = 0,11 м / сек$$

Speed of air movement on small ones – catathermometer, for large ones – an anemometer.

a) cylindrical, b) ball cathathermometer

general view of anemometers a) winged, b) cup

Independent work.

Students determine air velocity in the classroom and outdoors using cup and vane anemometers. Independently determine the rate of air exchange in the classroom by determining the speed of air movement through the window. Using Hill and ball catathermometers, the cooling properties of the air in the classroom are determined, in different places – near the window, in the middle of the room, near the door. Using the same data, the speed of air movement / micropulsation / is determined. Based on the results of a study of the complex impact of meteorological factors, a sanitary conclusion is made.

RECORD

research and assessment of the cooling properties of air

in_____

(Object name)

1. Date of examination _____time _____hour_____

2. The study was carried out **with a spherical catathermometer**

Ball catathermometer factor _____

Cooling time _____

Calculation of the cooling properties of air (ball catathermometer) using the formula:

3. The study was carried out **with a Hill catathermometer**

Hill catathermometer factor_____

Cooling time _____

Calculation of the cooling properties of air (Hill catathermometer) using the formula:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

4. Conclusion on the cooling regime in the examined room:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

The study was conducted by

(signature)_____

Teacher's signature _____

TEST

1. Conditions conducive to increasing heat transfer by radiation:

а) high temperature of surrounding surfaces

б) low temperature of surrounding surfaces

в) low air mobility

г) high air mobility

2. Conditions conducive to increasing heat transfer by:

а) low temperature of surrounding surfaces

б) high temperature of surrounding surfaces

в) low air mobility

г) high air mobility

3. Air movement speeds in the room are measured:

а) cup anemometer

б) vane anemometer

в) catathermometer

г) hygrometer

д) psychrometer

4. Wind direction is determined by:

а) cup anemometer

б) weather vane

в) catathermometer

г) vane anemometer

д) barometer

5. The rate of air movement in residential premises is:

а) 0.4–0.6 m/s

б) 0.1–0.3 m/s

в) 0.02–0.04 m/s

г) 0.05–0.1 m/s

д) 5.5–7.5 m/s

6. Catathermometers are used to determine:

а) t – air rye

б) relative humidity

в) air speed

г) absolute air humidity

д) air cooling capacity

7. Optimal thermal well-being in people who are usually dressed, busy with light work is observed with the readings of the catathermometer, the value is μcal /cm/sec:

а) 3.2–5.5

б) 5.5–7.0

в) 7.0–8.0

г) 10.0–12.0

д) 2.3–4.2

8. Optimal microclimate standards for dwellings, in contrast to acceptable ones:

а) do not depend on the person’s age

б) do not depend on a person’s age and depend on the climatic region

в) depend on the age of the person and do not depend on the climatic region

г) depend on the age of the person and the climatic region

9. When rising to altitude, the partial pressure of oxygen is:

а) is decreasing

б) does not change

в) rises

г) intensifies

10. The greenhouse effect is associated with an increase in the content of gases in the atmospheric air:

а) SO2, inert gases

б) CO2, NO2, methane, ozone

в) SO3

г) NH3

11. With increasing altitude under normal conditions, t – air air:

а) goes down

б) rises

в) does not change

г) changes abruptly

12. Natural gas composition of air:

a) Oxygen

b) Carbon dioxide

c) Nitrogen

d) Carbon dioxide

e) Inert gases

13. Ventilation of premises provides:

a) Compliance of concentrations of chemical pollutants with maximum permissible concentrations;

b) Optimal ion composition of air;

c) Correspondence of the microclimate parameters of the remote control unit;

d) Sufficient lighting;

e) Compliance with the control regulations.

14. Due to what factors is air exchange ensured:

a) Temperature difference

b) Wind direction

c) Wind force

d) Ventilation hole size

e) Building height

15. The microclimate of the premises is characterized by a set of indicators:

е) Temperature, humidity and air speed.

ж) Barometric pressure and temperature.

з) Temperature of surrounding surfaces.

16. Depending on the partial pressure of oxygen in the air at different altitudes, the following zones are distinguished (according to the degree of influence on the human body):

а) Indifferent zone

б) Full compensation zone

в) Zone of incomplete compensation

г) Critical zone

д) Death Zone

17. Carbon dioxide is an indicator of indoor air pollution:

а) direct

б) indirect

18. Physiological effect of carbon dioxide on the body:

a) Paralyzes the respiratory center

b) Has a narcotic effect

c) Stimulates the respiratory center

d) Affects vascular receptors

e) Acts on the central nervous system

19. Types of artificial ventilation:

a) Organized

b) Supply

c) Exhaust

d) Supply and exhaust

e) Conditioning

20. Name the types of natural ventilation:

a) Through ventilation

b) Air filtration through construction cracks

c) Ventilation using windows and transoms

d) Exhaust

e) General exchange

21. The cooling properties of air are measured:

а) mm. rt. st

б) kPa

в) %

г) μ /cm /sec.

д) m/sec.

22. Instruments for determining the cooling properties of air:

а) catathermometer

б) August psychrometer

в) hygrograph

г) statistical anemometer

LESSON 5

Determination of the light regime in the room (luxmetry)

1. Natural lighting in a room and its importance

The assessment of natural (daylight) lighting is carried out taking into account the factors that determine it: the light climate of the area, the time of day, the orientation of the room to the cardinal points, the proximity of green spaces outside the windows (no closer than 20 m), the proximity of neighboring buildings (no closer than double the height of the tallest building), the windows should preferably be square in shape, the cleanliness of the glass, the number of window sashes, protective barriers on the windows, the interior painting of the room (light colors), the size of the room.; window sill height – no more than 0.9–1.0 m; the distance from the top of the window to the ceiling is no more than 0.4 m.

Natural lighting is a powerful environmental factor, which affects not only a person's health and performance, but also the quality of various medical treatments: the surgical field is not sufficiently illuminated, etc. For dentists, workplace lighting is especially important, since the quality of work depends on it. Insufficient lighting causes overstrain of the visual analyzer and nervous system.

Note. In rooms facing west in areas 55˚N latitude. and to the south, for children aged 3 years and older and for adults, protection of premises from overheating by sunlight (blinds or other devices) should be provided.

In addition to the listed factors, when assessing natural (daylight) lighting, it is necessary to calculate several indicators: light coefficient, angle of incidence of light rays, opening angle, natural light coefficient, depth and laying coefficient

Natural lighting – illumination of premises by sunlight (direct or reflected) penetrating through light openings in external enclosing structures.

Natural side lighting – natural lighting of the room through light openings in the external walls.

Natural overhead lighting – natural lighting of the room through skylights, light openings in the walls in places where the heights of the building differ.

Natural combined lighting – a combination of overhead and side natural lighting.

Combined lighting is lighting in which natural lighting, insufficient by standards, is supplemented with artificial lighting.

General lighting – artificial lighting, in which lamps are placed in the upper zone of the room evenly or in relation to the location of the equipment (general localized lighting).

The stroboscopic effect is the phenomenon of distortion of visual perception of rotating, moving or changing objects in flickering light.

For normal natural lighting, the following sanitary standards have been established:

a) luminous coefficient /SC/ – this is the ratio of the glazed part of the window / area / to the floor area of the given room. C K in residential premises must be at least 1:8; in classrooms – 1:6; in operating rooms, dental offices, dressing rooms – at least 1:4;

b) laying depth – the distance from the outer wall to the most distant point of the room. It should not exceed twice the distance from the top edge of the window to the floor.

c) laying coefficient – the ratio of the laying depth to the height from the floor to the upper edge of the window. It should not exceed 2.5.

d) the angle of incidence of light rays on the working surface α shows at what angle the light rays fall on a given horizontal surface. It is formed by two lines emanating from the point under study: one horizontal in the direction of the window, and the other towards the upper outer edge of the window. It is determined by the formula $\alpha = \text{tg}\ (a / b)$, where *a* is the vertical distance from the top point of the window to the mental projection of the working surface onto the wall with the window.

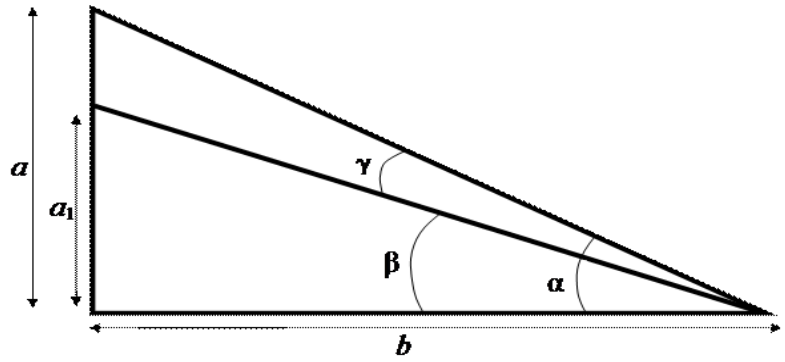


Fig. Illumination angles

Example of calculating the angle of incidence: *a* =2 m; *b* =3.9 m.

$$\operatorname{tg}\alpha = \frac{2}{3.9} = 0.51$$

Hence, according to the table of tangents, α=27º corresponds (Table 19). Therefore, the angle of incidence is 27º.

A is normalized to be no less than 27°. This value of a creates sufficient illumination of the working surface without glare. The angle of incidence is determined only for rooms with one-way lighting.

Tangent table

a/*b*	α˚	a/*b*	α˚	a/*b*	α˚	a/*b*	α˚
0.017		0.249		0.510		0.839	
0.035		0.268		0.532		0.869	
0.052		0.287		0.554		0.900	
0.070		0.306		0.557		0.933	
0.087		0.325		0.601		0.966	
0.105		0.344		0.625		1.00	
0.123		0.364		0.649		1.150	
0.141		0.384		0.675		1.390	
0.158		0.404		0.700		1.600	
0.176		0.424		0.727		2.050	

a/*b*	α°	a/*b*	α°	a/*b*	α°	a/*b*	α°
0.194		0.445		0.754		2.470	
0.213		0.446		0.781		3.070	
0.231		0.488		0.810		4.010	

e) the opening angle γ gives an idea of the size of the vault of heaven directly illuminating the place under study. It is formed by two lines – one drawn from the point under study to the upper outer edge of the window, and another line drawn from the same point to the highest point of the opposing building or object. The opening angle is calculated in cases where buildings outside the window or green spaces are located closer to the above standards. This reduces the usable area of the windows and reduces the natural light in the room. The opening angle is calculated from the difference between the angle of incidence and the angle creating darkness from a neighboring building or object located in front of the windows (the "darkening" angle – β).

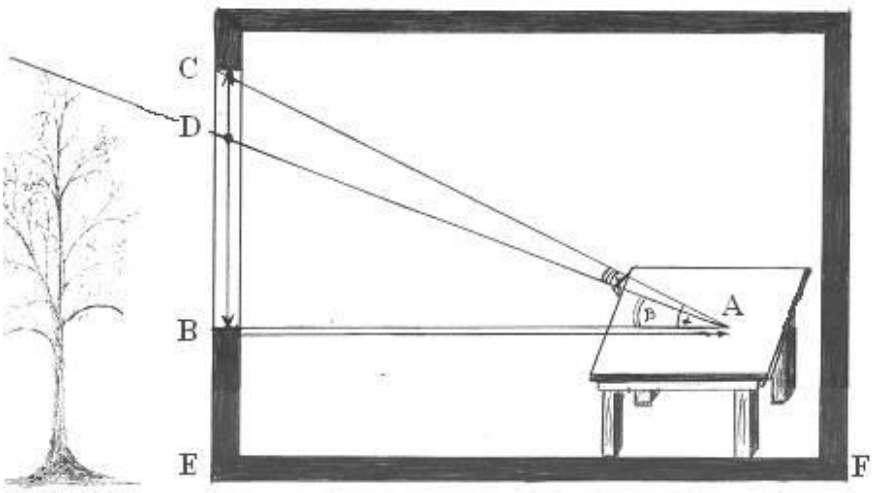
Example of hole angle calculation: a_1 =1.6 m; b =3.9 m.

$$\text{tg}\beta = \frac{1.6}{3.9} = 0.41$$

Hence, according to the table of tangents, β = 22º corresponds. Therefore, the hole angle is γ = α – β = 27º – 22º = 5º.

γ is normalized to be at least 5°. This angle is also calculated only with one-sided lighting

e) hole angle – formed by two straight lines emanating from the workplace; one connects the workplace with the top edge of the window, and the other goes from the workplace to the top edge of an object located outside the window / roof canopy of a neighboring house, the top of a tree / and blocking the sky. The opening angle must be at least 5°.



Scheme for determining the angle of incidence and the angle of the hole.

2. <u>Method for determining the natural illumination of a room</u>

a) Luminous coefficient/SC/ is determined as follows. The width and height of the windows along with the frame are measured with a measuring tape. By multiplying, we get the area of the window together with the frame. To obtain the area of the glazed part of the window, it is necessary from the obtained result subtract 10% of the resulting area. Using a measuring tape / tape measure / measure the width and length of the room and calculate the floor area. The ratio of the area of the glazed part of the window / windows / to the floor area will be the light coefficient.

EXAMPLE: The area of the window with the frame is 3.30 square meters. m. Subtract 10% from this area – 0.33, we get the area of the glazed part of the window – approximately 3.0 square meters. m. The floor area of the room is 18.0 square meters. m. The luminous coefficient will be equal to: 3.0 refers to I / the area of the glazed part of the window is taken as 1/18.0 refers to X

$$X = \frac{18,0 \cdot 1}{3,0} = 6,0$$

Therefore, C K for the studied room will be 1:6.

b) <u>Coefficient of natural light /KEO/</u>

Natural illumination coefficient (*KEO*) – the percentage of indoor illumination to outdoor lighting (in the open air), determined at the same time of day (with protection from direct sunlight). KEO. expressed as a percentage.

The natural light factor is determined by a luxmeter (a device for measuring illumination) and characterizes the illumination at a given time. A lux meter has a measuring part (a photosensitive selenium plate) connected to a galvanometer (recording part) graduated in lux (lx). One of the scales of the device registers the amount of illumination from 0 to 30 lux, and the other – up to 100 lux. The recording capabilities of the scales can be increased by 10, 100 and 1000 times with the help of appropriate filters, which are located in the device case. The filters are fixed with a special plate. The data obtained by the device is multiplied by the absorption coefficient and the illumination is obtained in lux. *KEO* is the most objective method for assessing natural light; it is determined at the workplace furthest from the window. In classrooms it should be at least 1.25%; in dressing rooms, manipulation rooms, maternity rooms, dental rooms – at least 1.5%, in operating rooms – at least 2%, in other areas of the hospital – at least 1%. Norm from 0.5% to 1.5%

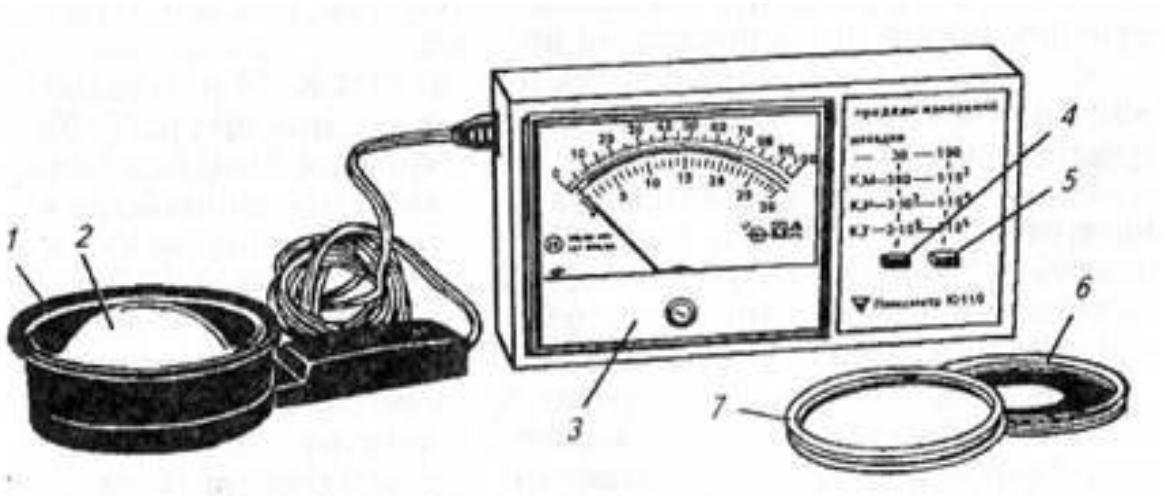
EXAMPLE: When determining the illumination at the workplace, a 100-fold absorption filter was used. The device showed 15 divisions. Illumination in the workplace is 15 x 100 = 1500 lux. When determining the illumination on the street, a 1000-fold absorption filter was used. The device recorded 95 divisions.

The illumination will be 95 x 1000 = 95000 lux.

$$KEO = \frac{1500 \cdot 100\%}{95000} = 1,5\%$$

Luxmeter





Luxmeter Yu-116

1 – selenium photocell in a plastic case with nozzles;

2, 6, 7 – nozzles; 3 – milliammeter;

4, 5 – buttons for switching measurement ranges.

3. An approximate method for determining artificial illumination

Artificial lighting of premises is characterized by a number of parameters.

First of all, this is a system for the location of IR sources: on the ceiling (general lighting), on the wall (lateral), only above the working surface (local), general in combination with local – combined.

Currently, fluorescent lamps are widely used as sources of IR – fluorescent lamps, based on the glow of a phosphor substance inside the lamp. These lamps do not emit heat, are economical, create sufficient uniformity of illumination, but also have a number of disadvantages (humming and noticeable flickering (manifestation of the stroboscopic effect) when the lamp malfunctions, the presence of toxic mercury inside the fragile cylinder, etc.).

The main task of artificial lighting is to create standardized quantitative and qualitative lighting indicators on working surfaces (operating rooms, work tables, patient beds, etc.).

The quantitative indicator of lighting is the illumination regulated by current standards on the working surface (horizontal, vertical, on the floor or a conventional surface). The required illumination, depending on the nature of the visual work performed in medical institutions, ranges from several lux (adaptive lighting) to tens

of thousands of lux (operating rooms). For wards in our country and abroad, a general illumination level of 100–150 lux is recommended

To determine the intensity of artificial lighting, count the number of incandescent lamps in the room and sum up their power. Specific the power of the lamps is multiplied by the coefficient "e", indicating which the number of lux gives a specific power of I watt depending on the power of the lamps and the voltage in the electrical network.

The value of the coefficient "e"

Lamp power	**Mains voltage**	
up to 110 watts	110–127 c.	220 c.
	2.4	2.0
110 watts and above	3.2	2.5

The results obtained are divided by the area of the room and receive the specific power of the degree of illumination in lux per 1 sq. m.

EXAMPLE: Room area 40 sq. m, lighting is provided by 4 incandescent lamps. Each has a power of 200 watts at a network voltage of 220 volts.

$$\text{Power density} = \frac{4 \cdot 200 \cdot 2{,}5}{40} = 50\ lux$$

Types of office rooms	**Illumination standard in accordance with SNiP, lux**	**Types of residential premises**	**Illumination standard in accordance with SNiP, lux**
Common office with PC	300	Living room, kitchen	150
Drafting table	500	Children's room	200

Types of office rooms	**Illumination standard in accordance with SNiP, lux**	**Types of residential premises**	**Illumination standard in accordance with SNiP, lux**
Conference hall, meeting room	200	Bathroom, toilet, shower room, apartment corridors and halls	50
Escalator, stairs	50–100	Dressing room	75
Hall, corridor	50–75	Office, library	300
Archive room	75	Stairs	20
Utility room, storage room	50	Sauna, swimming pool	100

Independent work

Students determine the luminous coefficient of a classroom by measuring the area of the glazed part of the window and the area of the floor. Working with a lux meter, each student determines the CNI for his workplace. The angles of incidence and openings, short circuit are also determined. The specific power of artificial lighting is approximately calculated. The data obtained on the state of natural and artificial lighting of the training room are summarized in the sanitary inspection report and presented at the end of the lesson to the teacher.

RECORD

study of lighting conditions in the classroom.

Natural light research

_____

(Object name)

1. In the classroom there are_____ windows, painting the walls_____

ceiling _____ cleanliness of window glass _____

presence of blinds and curtains on the windows _____

2. Determination of luminous coefficient:

window area_____m^2

glazing area _____ $m^{2,}$

floor area _____ $m^{2,}$

light coefficient _____

opening angle_____

angle of incidence _____

3. Daylight ratio:

external horizontal illumination _____ lx,

illumination at the workplace _____ lux,

CNI _____%.

Artificial light study

1. In this room, the lighting system _____

2. Calculation of artificial illumination by the number of lamps: floor area

_____

_____ number of fixtures

_____number of lamps

_____ power of one lamp

_____general power

_____specific power

Conclusion_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

The study was conducted by (signature)_____

Teacher's signature _____

TEST

1. The main biological effect of infrared rays:

а) ionizing effect

б) erythema- tanning effect

в) bactericidal

г) thermal effect

2. The main biological effect of ultraviolet rays of area A:

а) vitamin-forming

б) tan

в) fluorescent, photochemical action

г) bactericidal

3. Lamps are used to disinfect environmental objects:

а) bactericidal uviol glass

б) erythematous – uviolemic

в) daylight

г) incandescent lamps

4. The following device is used to measure illumination:

а) actinometer

б) lux meter

в) pyranometer

г) radiometer

д) hygrometer

5. Standard value of the angle of incidence:

а) no more than 27

б) at least 27

в) at least 5

г) at least 15

6. Standard value of hole angle:

а) at least 5

б) at least 27

в) no more than 5

г) no more than 15

д) at least 3

7. Luminous coefficient is:

а) the ratio of absolute illumination in the workplace to absolute illumination outside the building, expressed in %;

б) ratio of the depth of the room to the distance from the top edge to the floor;

в) ratio of glazed window area to room area;

г) ratio of the distance from the light-carrying wall to the opposite wall.

8. The depth of placement is:

а) the ratio of absolute illumination in the workplace to absolute illumination outside the building, expressed in %;

б) the ratio of the depth of the room to the distance from the top edge of the window to the floor;

в) ratio of glazed window area to room area;

г) ratio of the distance from the light-carrying wall to the opposite wall.

9. The natural light factor is:

а) the ratio of absolute illumination in the workplace to absolute illumination outside the building, expressed in %;

б) the ratio of the depth of the room to the distance from the top edge of the window to the floor;

в) ratio of glazed window area to room area;

г) ratio of the distance from the light-carrying wall to the opposite wall.

10. Illuminance unit:

а) luxury

б) lumen

в) nit

г) watt

11. The higher the humidity, the concentration of pollution in the ground layer of the atmosphere:

а) below

б) higher

в) more

г) less

12. Factors that reduce the intensity of solar radiation:

а) cloudy weather

б) increasing the angle of incidence of sunlight

в) air pollution

г) dustiness

13. In the optical part of the solar spectrum the following are distinguished: types of radiation:

а) cosmic

б) ultraviolet

в) infrared

г) visible

14. The main biological effect of ultraviolet rays

areas B:

а) vitamin-forming

б) erythematous – tan

в) fluorescent

г) bactericidal

15. Biological effect of visible rays:

а) vitamin D synthesis

б) ensuring vision function

в) influence on biological rhythms

г) erythema – tan

16. Changes in the body that occur with UV deficiency:

а) inhibition of hematopoiesis

б) stimulation of hematopoiesis

в) decreased body resistance

г) rickets

17. Possible adverse effects of solar radiation:

а) sunstroke

б) sensitization

в) hyperthermia

г) erythema

д) radiation sickness

18. The purpose of using artificial sources of UV radiation:

а) remediation of environmental objects

б) as additional light sources

в) prevention of UV deficiency

19. Indications for the use of artificial UV irradiation:

а) living in high latitudes
б) hypovitaminosis D
в) thyroid disease
г) neoplasms
д) working indoors without daylight

20. Standardization and assessment of existing and projected natural lighting is carried out according to the following indicators:

а) lighting
б) geometric
в) physiological
г) physical

21. Advantages of fluorescent lamps compared to incandescent lamps:

а) emit less heat
б) relatively short service life
в) emission spectrum is close to natural daylight
г) give off more heat

22. To determine the minimum artificial illumination using the “watt” method, you need to know:

а) room area
б) room volume;
в) room orientation

LESSON 6

Final lesson on the section "Hygiene of the air environment"

Purpose of the lesson: to consolidate the knowledge gained in practical classes and lectures on air hygiene.

The student must know: program questions on air hygiene taken on the exam and differentiated credit.

The student must be able to: use acquired practical skills in hygienic control in medical institutions and residential premises.

The student must master: a methodology for hygienic assessment of microclimate parameters in enclosed spaces based on instrumental studies using regulatory documents.

Questions for self-preparation: see questions for practical exercises.

The duration of the lesson is 90 minutes.

Test questions for the section and time calculation:

1. Organizational matters. Checking absent students using the log – **5 minutes**.
2. Programmed control on the topic of the lesson (tickets included).

Students choose tickets and answer three questions in writing (theory, practice, situational task). After 40 minutes, the teacher collects the answers and, after a break, in the presence of a group of students, checks the work, assigning marks for each answer. – **40 minutes.**

3. Break – **5 minutes**.
4. Checking students' written work and assigning grades. – **40 minutes**.
5. Explanation of the topic and purpose of the next lesson (“Water supply”) – **5 minutes**.

1. <u>Test questions on the theoretical part of the program</u>

1. Hygiene as a science, subject, content, its purpose and objectives.
2. History and stages of development of hygiene as a science.
3. Methods of hygienic research.

4. Laws of hygiene.

5. The concept of “Human Ecology”. Classification of environmental factors.

The role of environmental factors in the occurrence, course and outcome of diseases.

6. Classification of environmental factors.

7. Classification of types of reactions of the human body to the influence of environmental factors.

8. The structure of the atmosphere, layers of the atmosphere and their meaning for a person.

9. Existing global air currents on Earth. Meaning this natural environmental factor.

10. Spectrum of solar radiant energy. The impact on the human body of the visible part of the spectrum and its individual colors.

11. Meteopathies, causes, main clinical manifestations. Prevention of meteoropathy.

12. The ultraviolet part of the spectrum of solar radiant energy as a natural environmental factor. Impact of different parts spectrum on the body of a healthy and sick person. Use in medicine.

13. Infrared radiation as an environmental factor. Influence at public health. Use in medicine.

14. The mechanism of heat and sunstroke. Main clinical manifestations, first aid, prevention.

15. Principles of hygienic regulation natural and anthropogenic environmental factors.

16. Concept of climates. Climate-forming factors. Acclimatization, phases.

17. Chemical composition of the atmosphere, the importance of the gases that make up the atmosphere. The use of hyperbaric oxygen therapy in medicine.

18. The mechanism of occurrence of mountain sickness. Symptoms, first aid, prevention.

19. The mechanism of decompression sickness, symptoms, first aid, preventive measures.

20. Natural and anthropogenic sources of dust pollution. The impact of dust on the environment and humans.

21. Atmospheric pollution with gaseous impurities. The main sources of atmospheric pollution with sulfur dioxide. Effect on the body of a healthy and sick person.

22. Atmospheric pollution from exhaust gases of internal combustion engines. Impact of carbon monoxide /CO/ on the human body. First aid. The mechanism of action of carbon monoxide.

23. Ways to combat anthropogenic air pollution.

24. What types of ventilation do you know?

25. How does natural ventilation differ from mechanical ventilation?

26. Give the definition of maximum acceptable concentration and maximum acceptable limit.

27. What sources of air pollution do you know?

28. Hygienic importance of lighting.

29. Natural light indicators.

30. The most objective indicator of natural light.

31. Definition: hygienic diagnostics.

32. What is the difference between hygienic diagnostics and clinical?

33. What is the purpose of hygienic diagnostics and?

34. What is the purpose of clinical diagnosis?

35. What is “prenosological diagnosis”?

36. What methods are used to measure a person's physical condition?

37. List direct indicators of health.

38. What are “stress tests” and what are they used for?

39. How to assess a person's mental state and health?

40. Definition of “mental health” according to N. Sartorius?

41. Can “mental health” be maintained in the presence of a disability or other illness”?

42. What indicators are used to characterize the health of a population?

43. What do “medical and statistical indicators” include?

44. What is the structure of morbidity?

45. What characterizes the incidence rate?

46. What indicators characterized by poor health of the population are called morbid?

47. What is the name of the science that studies health at the population level?

48. Which categories of the population are primarily in the sphere of hygiene interests?

49. First of all, what factors are considered to determine health?

50. To what extent does the health of a person or population depend on these groups of factors?

51. What is the task of hygienic diagnostics?

52. Definition of hygienic standardization.

53. What is HS based on?

54. How are hygiene standards established?

55. What is a prerequisite for objective HS?

56. What does it take to plan an experiment?

57. What models are built using statistical processing when conducting an experiment?

58. What concepts are used when conducting an experiment?

59. Where is HS carried out?

60. What is the methodological and methodological basis for hygienic regulation?

61. What interrelated principles is HS based on?

62. How many basic principles of HS and their names?

63. What is the essence of the “warranty” principle?

64. What is the name of the second principle of HS and what does it imply?

65. What is the essence of the third principle of HS?

66. How many levels does the principle of differentiation have?

67. List zones or levels of differentiation of maximum and minimum values.

68. What is the essence of the fourth principle of HS?

69. Express with an equation the dependence of the fourth principle of HS and who was the first to describe its essence.

70. Name of the fifth principle of HS?

71. What is the source material indicating the need to change a previously approved standard value?

72. What indicators are leading when changing a previously approved standard value?

2. Test questions for the practical part of the program

1. Thermometry. Determining the temperature in a hospital ward. Selection of points for determining temperature and their hygienic justification.

2. Types of thermometers. Existing temperature scales.

3. Barometry, types of barometers. Units of measurement of barometric pressure" The significance of this environmental factor and the impact on a healthy and sick person.

4. Determination of relative humidity by hygrometric method. What devices exist for this? The significance of this environmental factor and its impact on a healthy and sick person.

5. Determination of air humidity. Types of humidity. What instruments are used to determine absolute humidity.

6. Psychrometry, types of psychrometers. What are these devices used for? Meaning determined factor. Norms and their rationale.

7. Determination of humidity by August's psychrometer. The principle of operation of the device, the existing shortcomings.

8. Assmann psychrometer, principle of operation. To determine what parameters of the microclimate it is used.

9. Anemometers, anemometry. To determine what parameters of the microclimate these devices are intended for. Types of anemometers.

10. Air movement as an environmental factor. Instruments for determining air speed. Impact on healthy and sick people.

11. Catathermometry, types of catathermometers. What microclimate parameters are determined by catathermometry. Units.

12. A method for determining the complex effects of microclimatic parameters on the body. Devices, units of measurement.

13. Hill's catathermometer. Principle of operation. What microclimate parameters are determined using this method?

14. Ball catathermometer. Advantages, principle of operation. What microclimate parameters are determined by this device?

15. Determination of micropulsations of air movement in a room. What devices are used for this.

16. Determination of luminous coefficient (LC). The importance of LC in the prevention of overfatigue of the visual analyzer.

17. Objective luxmetry and environmental parameters that are determined in this case. Luxmeter device. Rules for working with it.

18. Determination of the coefficient of natural illumination (CNI). The importance of CNI in the work of a general practitioner.

19. Determination of incidence angles and openings. Standardization of these indicators and their hygienic justification.

20. Approximate definition of artificial lighting in hospital wards, dressing rooms, and operating rooms. Determination of the specific power of artificial lighting in the workplace.

3. Situational tasks for the section "Air hygiene"

Task:(sample)

When studying the microclimatic conditions in the room, the following data were obtained: relative air humidity was 20%, air temperature 23^0 C, air speed 0.05 m/s.

1. What thermal sensations will prevail under these microclimate parameters?
2. Which method of heat transfer will prevail in a given microclimate?

Answer:

Under these microclimatic conditions, the room will be stuffy (due to the increased air temperature and low air speed).

Heat transfer by evaporation will predominate, since at high temperatures of the air and, accordingly, surrounding objects, heat transfer by conduction and radiation will be reduced, and low air speed (less than 0.2 m/s) indicates weak air exchange

1. The patient's temperature is 98.8˚ Fahrenheit. It is necessary to calculate the temperature in Celsius and Reaumur.

2. When determining the cooling properties of the air in the clinic reception area using a Hill catathermometer, the following results were obtained: cooling time – 81 seconds, catathermometer factor – 655. It is necessary to calculate the cooling properties of the air and give a conclusion about the state of the microclimate.

3. Give a hygienic description of the microclimate parameters in the therapist's office: temperature 14.5˚Réaumur, humidity – 70%, amount of carbon dioxide – 0.12%, light coefficient 1:8, opening angle – 4˚, cooling properties of air – 6.5 μcal /sq. cm/sec.

4. In the postoperative ward of the hospital, the temperature at a level of 0.5 m from the floor was 16.0° Reaumur. Humidity – 75%; amount of carbon dioxide – 0.1%; light coefficient – 1:8. It is necessary to calculate the temperature in Celsius and Fahrenheit, and based on the data make a sanitary conclusion.

5. The temperature in the X-ray room is 60.8° Fahrenheit. Necessary Express in degrees Celsius and Reaumur.

When determining the cooling properties of air in the foyer of the cardiological department of the Republican Clinical Hospital using a ball catathermometer, the following results were obtained: cooling time.

6. 90 seconds, catathermometer factor – 930. It is necessary to calculate the cooling properties of air and give a conclusion.

7. The patient's body temperature is 29.8°Réaumur. It is necessary to calculate the temperature in degrees Celsius and Fahrenheit.

8. When determining the cooling properties of air in the preoperative ward with a ball. The following results were obtained using the catathermometer: time cooling – 70 seconds; catathermometer factor – 925. It is necessary to calculate the cooling properties of air and give a conclusion.

9. It is necessary to give a hygienic assessment of the microclimatic parameters in the postoperative ward of the surgical department of the Republican Clinical Hospital: temperature 14.5° Reaumur, humidity – 70%, amount of carbon dioxide – 0.12%; cooling properties of air – 4 μcal /sq. cm/sec.

10. When determining the cooling properties of air in an ophthalmologist's office using a Hill catathermometer, the following results were obtained; cooling time – 150 seconds; catathermometer factor – 510. It is necessary to calculate the cooling properties of air and give a conclusion.

11. The patient's temperature is 100° Fahrenheit. Must be expressed in degrees Celsius and Reaumur.

12. Hill catathermometer gave the following results: cooling time – 120 seconds; catathermometer factor – 620. It is necessary to calculate the cooling properties of air and give a conclusion.

13. Give a hygienic assessment of the parameters of the microclimate and natural light in the ophthalmologist’s clinic office: temperature – 68° Fahrenheit; humidity – 55% cooling properties of air – 5.0 μcal / sq. cm / sec, amount of carbon dioxide - 0.11%; SK – 1:8, KEO – 0.55%.

14. Give a hygienic description of the microclimatic parameters and natural light in the hospital general therapeutic profile: temperature – 14.5° Reaumur; humidity – 65%; cooling properties of air – 6.2 μcal /sq. cm/sec; amount of carbon dioxide – 0.09%, C K – 1:7; KEO – 0.8%.

15. Give a hygienic description of the microclimatic parameters in the ward of the gastroenterology department of the Republican Clinical Hospital: temperature –

15.5˚ Reaumur; humidity – 65%; cooling properties of air – 4.0 μcal /sq. cm/sec., amount of carbon dioxide – 0.15%; SC –1:8; KEO – 0.45%.

16. Give a hygienic description of the microclimatic parameters of the foyer where patients in the endocrinology department of the RCH hospital eat: temperature – 71.5° Fahrenheit; humidity – 55%; cooling properties of air – 5.5 μcal /sq. cm/sec; amount of carbon dioxide – 0.09%, C K – 1:10; KEO – 0.45%.

17. When studying the cooling properties of air in the urban corridor **At the clinic,** the following results were obtained using a Hill catathermometer: cooling time – 81 seconds; catathermometer factor – 565. It is necessary to calculate the cooling properties of air and give conclusion.

18. Give a hygienic description of the parameters in the training room of the Department of General Hygiene and Human Etiology: temperature – 80° Fahrenheit; humidity – 55%, amount of carbon dioxide – 0.1%; cooling properties of air – 4.5 μcal /sq. cm/sec; SK – 1:7: KE O – 1.8%.

19. The temperature in the ward for planned preoperative preparation of patients is 59° Fahrenheit; cooling properties of air – 6.5 mcal /sq. cm/sec; air movement – 0.1 m/sec; the amount of carbon dioxide is 0.08%. Based on the above data, it is necessary to give a hygienic characteristic of the microclimate.

20. Give a hygienic description of the microclimatic parameters in the lecture hall of the morphological building: temperature – 14° Reaumur; humidity – 75%, amount of carbon dioxide – 0.15%; cooling properties of air – 5.5 μcal / SQ. cm /sec, SC – 1:10; K E O – 0.25%.

Independent work

Students choose tickets and answer three questions in writing – one from each section, and solve situational problems. After 45 minutes, the teacher collects the answers and, after a break, in the presence of a group of students, checks the work, assigning marks for each answer.

Topics for reports:

1. Climatic features of the Republic of Dagestan and its hygienic significance.
2. Features of the climate of mountainous and high-mountain Dagestan and its hygienic significance.
3. Features of acclimatization in high altitude conditions in temperate latitudes.
4. Caisson disease and its prevention.
5. Mountain sickness and its prevention.
6. Modern issues of atmospheric air protection.
7. Problems of air pollution in large cities.
8. Motor transport as a source of air pollution.
9. “Sun fasting” and its prevention.
10. Effect of non-ionizing radiation on humans.

References

Main sources of information:

1. Lectures on general hygiene.

2. Hygiene with the basics of human ecology: [Electronic resource] textbook. for students Universities. / ed. P. I. Melnichenko. – M.: GEOTAR-Media, 2010. 752.

Additional sources of information:

1. Popov V. I., Faustov A. S., Fertikova T. E., Leonov V. I., Kamenev V. I., Libina I. I., Mazurenko N. Yu. General hygiene: Educational and methodological manual of the State Educational Institution of Higher Professional Education “Voronezh State Medical Academy named after. N. N. Burdenko FA for Health and Social Development".

2. General hygiene: textbook / ed. A. M. Bolshakova, V. G. Maimulova. – M.: GEOTAR-Media, 2006. – 736 p.

3. General hygiene: lecture notes / Yu. Yu. Eliseev, I. N. Lutskevich, A. V. Zhukov, Yu. V. Kleshchina, A. N. Danilov. – M.: Eksmo, 2006. – 192 p.

4. Ushakov I. B., Popov V. I., Soldatov S. K. The influence of ionizing radiation on humans (a short guide). – Voronezh: Voronezh State University, 2000. – 52 p.

5. Faustov A. S., Popov V. I. Hygiene: lecture course notes: Textbook for students of medical universities (Recommended by the Educational Institution for Medical and Pharmaceutical Education of the Ministry of Defense and the Ministry of Health of the Russian Federation). – Voronezh: VSU, 2001. – 144 p.

6. Faustov A. S., Popov V. I., Kamenev V. I. Hygiene in graphs, drawings, tables and diagrams: A textbook for students of medical universities (Recommended by the All-Russian Educational, Scientific and Methodological Center for Continuing Medical and Pharmaceutical Education of the Ministry of Health of the Russian Federation). – Voronezh: Publishing House “Istoki”, 2001. – 184 p.

7. Ecology: textbook for universities with adj. on CD / ed. A. I. Grigorieva. – M.: GEOTAR-Media, 2008. – 240 p.

8. Human ecology and preventive medicine: Megathesaurus – Large dictionary-reference book / Author-comp.: I. B. Ushakov, P. S. Turzin, N. A. Agadzhanyan et al. / Ed. Corresponding member RAMS I. B. Ushakova. – Moscow – Voronezh: IPF “Voronezh”, 2001. – 488 p.

Regulations:

1. SanPiN2.2.4.548-96 “Hygienic requirements for the microclimate of industrial premises.”

2. GOST 30494-96 “Residential and public buildings. Indoor microclimate parameters."

3. SanPiN 2.1.3.2630 – 10 “Sanitary and epidemiological requirements for organizations engaged in medical activities.”