HEALTH MINISTRY OF THE REPUBLIC OF MOLDOVA

UNIVERSITY OF MEDICINE AND PHARMACY, CHISINAU
HYGIENE DEPARTMENT

NOTEBOOK

Reports for laboratory works

Name _____

Faculty _____

Year _____

Group _____

CHISINAU, 2019

The PLAN

of theoretical lectures on General hygiene,

for second year students of the faculty of Medicine nr. II

(III-semester)

Nr	**Topics**	**Nr. of hours**	**Absents date**
1.	Hygiene, general concept. The importance of hygiene as basic subject of the prophylactic medicine. The principles of hygienic norms.	2	
2.	Nutritional hygiene. Rational feeding. Energy consumption. Energetic value of food ration.	2	
3.	Qualitative content of food ration.	3	
4.	Nutritional pathologies and their prophylaxis.	2	
5.	Hygiene of water and water supply.	2	
6.	Hygiene of the air. Hygienic importance of the physical chemical factors of the air. Air pollution.	2	
7.	Hygienic assessment of lighting, ventilation and hotness of miscellaneous spaces.	2	
8.	Military hygiene as object of study, aim and objectives, researches methods. Hygienic supply in the National Army. Sanitary organization and supervision of the feeding and water supply in the company troops in the field condition.	2	
Total		**17**	

The PLAN

of practical lessons on General hygiene,

for second year students of the faculty of Medicine nr. II

(III-semester)

Nr	**Topics**	**Nr. of hours**	**Absents date**
1.	Study of the individual feeding.	2	
2.	Assessment of the nutritional correctitude trough the method of calculations.	2	
3, 4.	Hygienic assessment of the quality of certain food products (sanitary expertise of same of the main food products).	4	
5.	Research of the content of vitamins in food products. Assessment of vitamin value of the food ration. Vitamin C supplying control.	2	
6, 7, 8.	The organization and supervision of the nutritional process in the National Army.	6	
9.	Sanitary inspection on organization the nutritional process in the hospitals.	2	
10, 11.	Food poisoning and their prophylaxis, method of research.	4	
12, 13	Hygienic assessment of the microclimate in the children establishments and hospitals.	4	
14.	Chemical factors of the air environment and their influence on human body. Air pollution with bacteria and dust. Express methods of determining the chemical substances from air. Determining CO_2 according to the method of Vinocuroff.	2	
15, 16.	Hygienic assessment of lighting, ventilation and hotness of miscellaneous spaces.	4	
17.	Test of practice skills.	2	
Total		**34**	

Work report for Practical lesson Nr 1

Date _____ /_____ /_____

Topic: ***Hygienic evaluation of individual feeding. Study of personal alimentation.***

The purpose of study:

_____

_____

Work report

Complete this table:

Index	Body weight	Energy (Q)	Corrections	Your Opinion
Real				
Ideal theoretical				

ITBW= height,cm×0,7-50

For men Q=815+36,6× ITBW

For women Q=530+31,1× ITBW

Task:

John is a student 20 years old with height 167 cm and weight 62 kg. Daily he has a 3 hot meals from fast food. For breakfast he take a coffee with milk and cake, at 12 o'clock meat with salad do from a vegetables, one hot tea, and for a diner he take a 2 portion of French fries (70g) and 2 hamburgers (350 kcal for one) and some water. During the day also eats some fruits and candy.

a) Appreciate the students' alimentation
_____

_____

What you can recommend to John

_____

_____

Conclusion: for your body weight

_____

1. Your ITBW is _____ (Britman's)
2. What is Q for your body _____ Kcal
3. The difference between your ideal body weight and the real is_____ kg .

Teacher signature_____

Information note

Body Mass Index (BMI) is a number calculated from a person's weight and height information. BMI is equal to a person's weight in kilograms divided by the height in meters squared or BMI=kg/m2. The resulting number provides a dependable estimate of body fat levels for most people and is used to identify weight categories that could result in health problems. Body mass index is the preferred method of measurement for many physicians and researchers who study obesity.

weight (kg) / [height (m)]^2

You can compare your BMI to this table to help you determine whether you're at a healthy weight.

- **Underweight = less than 18.5**
- **Normal weight = 18.5-24.9**
- **Overweight = 25-29.9**
- **Obese = 30 or greater**

BMI is a measure which takes into account a person's weight and height to gauge total body fat in adults. If someone has a BMI rating of 26 to 27, they are around 20 percent overweight and have moderate health risks. A person with a BMI of 30 or higher higher is considered obese. The higher your BMI, the greater your chance of developing health problems. Find out if your Body Mass Index puts you at risk.

Please remember that this calculator is meant to be an estimate for motivational and planning purposes only. Body Mass Index is only a basic body measurement which can sometimes be misleading for anyone who is already an skater or athlete in another sport. This is because BMI is based on height and weight and for both adult men and women, but it does not take into account the weight of well developed muscle for active sports enthusiasts. There are other methods that can help find a more accurate BMI for some who are already active athletes.

Practical lesson Nr 2

Date _____ /_____ /_____

Topic: ***Apprecietion of individual alimentation. Determination of the organism's requirements in energy.***

The purpose of study:_____

_____

_____

Work report

nr	Activities	Duration (min)	Kcal/kg (Q)	min × Kcal/kg
		24 hours (1140min)		kcal× BW

To the result is added 10-15% from the obtained number, that reflects the unregistered actions.

The obtained result of energy consumption is compared with the norms of energy necessity for different groups of population.

Conclusion: My energy consumption is **_____ kcal**

Teacher signature_____

Energy consumption, including basal metabolism for 1 kg of body weight per minute

nr	*Activities*	Energy consum. kcal/kg/ min	**nr**	*Activities*	Energy consum. kcal/kg/ min
1	*lessons*	0,0243	**20**	*Taking a shower*	0,0570
2	*Laboratory classes*	0,0360	**21**	*Cleaning clothes, shining shoes*	0,0493
3	*Practical classes (without laboratory analysis)*	0,0250	**22**	*Dressing and undressing*	0,0264
4	*Practical classes in a food service location*	0,0400	**23**	*Resting in bed*	0,0183
5	*Therapeutic class practice*	0,0260	**24**	*Resting in a sitting position*	0,0229
6	*Surgery class practice*	0,0266	**25**	*Resting while standing*	0,0264
7	*Lesson breaks*	0,0243	**25**	*reading*	0,0230
8	*Getting ready for the classes*	0,0250	**27**	*Reading in a loud voice*	0,0250
9	*Moving on a paved road*	0,0597	**28**	*singing*	0,0250
10	*Moving on a country road*	0,0625	**29**	*Dancing (waltz)*	0,0596
11	*Transport moving*	0,0267	**30**	*Morning exercises*	0,0648
12	*Doing farm chores around the house*	0,0757	**31**	*Running (speed 8 km/h)*	0,1357
13	*Taking care of children*	0,0360	**32**	*Running (speed 180 m/min)*	0,1780
14	*Room clean-up*	0,0402	**33**	*Running (speed 320 m/min)*	0,3200
15	*Hand-washing clothes*	0,0511	**34**	*Riding the bike (13-26 km/h)*	0,1285
16	*Washing dishes*	0,0313	**35**	*Skating*	0,1071
17	*Hand sewing*	0,0264	**36**	*Swimming*	0,1190
18	*Taking a meal*	0,0236	**37**	*Sleeping*	0,0155
19	*Washing the body*	0,0514			

Practical lesson Nr 3

Date _____ /_____ /_____

Topic: ***Hygienic assessment of vitamin value of some foodstuffs. Determination of the contents of vitamin C in some alimentary products. Examination of the vitamin assurance of the organism.***

The purpose of study:

_____

_____

Work report:

For your information: $x = \frac{nFN \times 100 \times 0{,}088}{ap}$

Determination of ascorbic acid through the titer method with Tilmans reactive.

_____

_____

_____

_____

_____

_____

_____

_____

Conclusion:

What is the level of vitamin C in the potato? _____ (norm 20mg/100g of product)

What is the level of vitamin C in the boiled potato?_____

What is the level of vitamin C in the onion?_____(norm 10mg/100g of product)

What is the level of vitamin C in the cabbage? _____(norm 30mg/100g of product)

What is the result of the "Nesterov" probe? _____(norm till 15 red points)

What is the result of the "Tilmans" probe?

_____

Teacher signature_____

Information note

Vitamins and minerals boost the immune system, support normal growth and development, and help cells and organs do their jobs.

Vitamins fall into two categories: fat soluble and water soluble.

The **fat-soluble** vitamins — A, D, E, and K — dissolve in fat and can be stored in your body.

The **water-soluble** vitamins — C and the B-complex vitamins (such as vitamins B6, B12, niacin, riboflavin, and folate) — need to dissolve in water before your body can absorb them. Because of this, your body can't store these vitamins. Any vitamin C or B that your body doesn't use as it passes through your system is lost. So you need a fresh supply of these vitamins every day.

Name	***Main occurrence***	***Effectiveness***	***Lack***	***Overdosing***	***Daily need***
Vitamin A(Retinol)	Cod-liver oil, liver, kidney, milk products, butter, yolk, as provitamine A in carrots	Normal growth, function and protection of skin, eyes and mucous membrane	Growth stop, night blindness	Impaired visions, headache, nausea, vomitus, tiredness, skin change	approx. 1 - 5mg
Vitamin B1(Thiamin)	Wheat germs, wholemeal cereals, peas, heart, pork, barm, oatmeal, liver, brown rice	Important for the nerve system, liver damage, inefficiency, pregnancy, mosquito protection (high-dosed), production of energy, affects the carbohydrates metabolism, important for the thyroid function	Heavy muscle- and nerve disturbances, tiredness, dyspepsias, dropsy, cardiac insufficiency, cramps, paralyses, prickle in arms and legs	none	approx. 2mg (At carbohydrates-packed nutrition some more)
Vitamin B2(Riboflavin)	Milk products, Meat, wholemeal cereal, cheese, eggs, liver, sea-fish, green leafy vegetables, whey powder	Important for body growth, untilization of fats, protein and carbohydrates, well for skin, eyes and nails, important energy bringer, oxygen transport	(rarely) skin inflammation, brittle nails, anaemia, callus attrition	not known	approx. 2 mg
Name	**Main occurrence**	**Effectiveness**	**Lack**	**Overdosing**	**Daily need**
Vitamin B3(**Niacin**, Nicotine acid)	Barm, peanuts, peas, liver, poultry, fish, lean meat	Building and degradation of fat, protein and carbohydrates, good sleep	Skin and mucosa inflammation, headache, trembling, vertigo, sleep disturbance, depressions, feeling	(with over 100mg a day) pruritus, nausea, allergies	13 - 16 mg

			of prickle and deafness in the limbs		
Vitamin B5(Pantothen acid)	Liver, vegetable, wheat germs, asparagus, crabs, meat, sunflower cores, Pumpernickel	Against turning grey, hair loss, hair and mucous membrane illnesses, necessarily for the dismantling of fat, proteins and carbohydrates	Nerve malfunctions, bad healing of wounds, early turning grey, weakened immune system	Over urine excreted	approx. 10 mg
Vitamin B6(Pyridoxin)	Bananas, nuts, wholemeal products, yeast, liver, potatos, green beans, cauliflower, carrots	Travel sickness, neuralgia, liver damage, premenstrual syndrome, digestion of protein, most important hormone in pregnancy together with folic acid, detoxication	(rather rarely) intestine problems, bad skin, tiredness, rough corners of the mouth	With intake of this for a longer time in form of tablets it can deposit in the body tissue and lead to nerve damages.	approx. 2 mg
Name	**Main occurrence**	**Effectiveness**	**Lack**	**Overdosing**	**Daily need**
Vitamin B7(**Biotin**, Vitamin H)	Liver, cauliflower, champignons, wholemeal products, eggs, avocado, spinach, milk	Skin deseases, loss in growth of hairs, liver damage, assists metabolism, carbohydrate and fatty acid activity, together with vitamin K it is needed for building up the clotting factors	States of exhausting, skin inflammations, muscular pains, hair loss, nausea	not known	approx. 0,5 mg
Vitamin B9(**Folic acid**, Vitamin M)	Liver, wheat germs, cucurbit, champignons, spinach, avocado	Liver damage, cell division, healing and growth of muscles and cells, protein metabolism	Anaemia, digesting disturbances, disturbances of hair -, bone and cartilage growth	Allgergies, sleep disturbances and bad moods (with more than 15 mg a day)	approx. 160 µg
Vitamin B12(Cobalamin)	Liver, milk, yolk, fish, meat, oysters, quark, barm	Building substance of cytoblast and erythrocyte, nerve pains, skin and mucosa inflammation, liver damage	Aenaemia, nerve disturbances, nervous disturbances, changes in the lung and the spinal marrows	Not possible, because surplus B12 will be excreted by the body	approx. 5 µg
Name	**Main occurrence**	**Effectiveness**	**Lack**	**Overdosing**	**Daily need**
Vitamin C(ascorbic acid)	Dogroses, sea buckthorn, citric fruits, black currants, potatoes, paprika, tomatoes, collard,	Inflammation and bleeding-restraining, assists the body's defences, protects cells against chemical destruction, activates enzymes, structure of	Gum-bleed, tiredness, joint pain and headache, bad healing of wounds, lack of appetite,	In the case of overdosing in form of powder and	approx. 75 mg - 200 mg

	spinach, vegetables, radish	connective tissue, bones and dental enamel, faster healing of wounds, stabilisation of psyche	scurvy, inefficiency	pills nausea, vomiting and urine stones can be the result.	
Vitamin D(Calciferol)	Cod-liver oil, liver, milk, yolk, butter, sea fish, herring, champignons, avocado	Regulation of calcium- und phosphat household, structure of bone, assits admission of calcium	Bone curvature and softening, increased infection sensitivity, amyasthenia	(only with man-made Vitamin D) Calcium deposists in bones, heart muscle, blood vessels, stomach, headache, vomiting, swindle, gastro-intestinal diseases	approx. 5 µg
Vitamin E(Tocopherole)	Sunflowers -, corn -, Soja and wheat germ oil, nuts, flaxseed, salsify, peperoni, collard, avocado	Stabilization of the immune system, anti-inflammatory, cell replacement, protection from radicals, modulates cholesterol level and hormone household, important for blood vessels, muscles and reproduction organs	(rarely) amblyopia, tiredness, amyotrohia, dislike, reproduction problems	(particularly by synthetically manufactured caps) bad healing of wounds, deficiency symptoms, swindle, nausea	10 - 30 mg (with fat-enrich nutrition more)
Vitamin K(Phyllochinone)	Eggs, liver, green collard, green vegetable, bulbs, oatmeal, kiwi, tomatoes, cress	Necessary for formation of the blood clotting factors	High doses of vitamin A and E work against vitamin K.	With intake for a longer time, it can become toxid, bleedings, hot flashes, renal diseases	approx. 2 mg

Practical lesson Nr 4

Date _____ /_____ /_____

Topic: ***Hygienic examination of quality of some foodstuffs (sanitary test).***

The purpose of study:

_____

_____

Work report:

Would you explain what the hygienic importance of the milk is?

_____

_____

_____

_____

_____

What kind of contra faction of the milk can be?

_____

_____

Result table

Test kind	1	2	3	4	5	Norma
taste						
color						
smell						
density						1,027-1,034
soda						-
starch						-
Acidity						20-25˚T

Conclusion:_____

_____

_____

_____

Teacher signature_____

Information note

Milk is a perishable commodity and spoils very easily. Its low acidity and high nutrient content make it the perfect breeding ground for bacteria, including those which cause food poisoning (pathogens).

The type of animal, its quality, and its diet can lead to differences in the colour, flavour, and composition of milk. Infections in the animal which cause illness may be passed directly to the consumer through milk. It is therefore extremely important that quality-control tests are carried out to ensure that the bacterial activity in raw milk is of an acceptable level, and that no harmful bacteria remain in the processed products.

Milk can be kept for longer periods of time if it is heated to destroy the bacteria or cooled to slow their growth. Pasteurization and sterilization are the two most commonly-used heat treatments. Technically, it is possible for both to be carried out on a small scale, but they are most usually performed on a larger industrial scale due to the need for qualified, experienced staff and accurate and strictly controlled hygienic processing conditions.

Pasteurization is a relatively mild heat treatment, (usually performed below 100°C) which is used to extend the shelf-life of milk for several days. It preserves the milk by the inactivation of enzymes and destruction of heat-sensitive micro-organisms, but causes minimal changes to the nutritive value or sensory characteristics of a food. Some heat-resistant bacteria survive to spoil the milk after a few days, but these bacteria do not cause food poisoning.

The time and temperature combination needed to destroy 'target' microorganisms will vary according to a number of complex inter-related factors. For milk, the heating time and temperature is either 63°C for 30 minutes or alternatively 72°C for 15 seconds. In summary, the process of sterilization requires a considerable capital investment, the need for trained and experienced staff, regular maintenance of sophisticated equipment, and a comparatively high operating expenditure.

Cooling

Pasteurization does not destroy all of the micro-organisms, therefore the milk has to be cooled rapidly to prevent the growth of surviving bacteria. Cooling can be achieved on a small scale by using a bottle-cooling system.

Storage

Pasteurized milk has a shelf-life of 2-3 days if kept at 4°C. Maintaining this low temperature causes a substantial increase to the cost of transportation and distribution and is therefore a major disadvantage to the development of a small-scale pasteurized milk business. If packaged in sealed bottles and stored at room temperature, sterilized milk should have a shelf-life in excess of six months.

Food sampling technique

For the results of laboratory tests to have as much interpretive value as possible, and to reflect realityaccurately, it is imperative that samples be transported to the laboratory in the shortest time, and in sucha manner that the characteristics of the food samples will not change since the moment of collection.Food samples will be collected taking into account their nature, in general, in bottles or jars,perfectly clean, plugged with new and clean corks or polished glass stoppers, or

clean paper bagsso as not to influence the composition of food, and not to constitute a means of provoking rapiddeterioration. If the products are contained in packages of less than 1 kg or 1 liter - for liquids,take the original, unopened packaging.Food control includes the organoleptic and physico-chemical testing, the content in nutrients,the loading ionizing radiation, the toxicity, falsification, improper addition of additives or pesticides,the quality of packaging used.

Organoleptic examination of milk
• appearance: the milk is poured from a bowl to another, observing its homogeneity and the presence of foreign bodies
• color: it is poured into a colorless glass cylinder and the color is observed in daylight
• consistency: passing the milk from one bowl to another, observing whether it flows easily oritis continuously viscous
• smell and taste: the sample is heated to 50-600C and evaluated
• taste is assessed at 15-200C

Organoleptic examination of cheese products, follows:
• appearence (homogenous mass, mold, dirt)
• consistency
• color (shell, core)
• smell and taste.

Table 1. Milk organololeptic properties

Features	**Normalized milk**	**Skimmed milk**
Aspect	Liquid, homogeneous, opaque, completely free of visible impurities and it settles (homogeneity and opacity)	
Consistency	Fluid	Fluid
Colour	White with slight yellow tint, uniform throughout the mass	White, with a slight blue tint, uniform
Smell and taste	Pleasant, sweet, characteristic of fresh milk without foreign taste and odor; in pasteurized milk a slight boiled taste is allowed	

Organoleptic examination of meat follows:
• the aspect of the surface and in section
• color
• consistency
• digital impression
• odor
• the aspect of fat
• the aspect of the marrow
• the aspect of joints and tendons
• broth

Table 2. Organoleptic examination of meat

Organoleptic characteristics	Chilled and dry meat	Frozen meat	Meat with advanced deterioration
Surface Appearance	Dry film	Compact block, sometimes covered with a thin layer of fine crystal.	Wet and sticky, covered with mucus or mold
The appearance of the section	A little wet, the juice is removed by pressure hard and is clear	By pressing with a hot knife, an intense red stain is observed	Separated, thin, flattened, broken muscle fibers, with fluid-filled spaces
Color	From pale pink to red or darkred (beef)	Vivid red. sometimes darker	Opaque, dark color, gray green
Consistency	Elastic, firm	Hard as ice, on impact it gives a clear sound	Low
Digital Impression	Traces that are formed when pressed reverts quickly (less than 1 minute)	Disappear more slowly	The finger impression is not reverted
Odor	Pleasant, characteristic for each species	Without odor or wet odor(acid)	Slightly acid, moldy, rotting
Grease	In cattle, sheep, goat the fat is yellowish-white, hard, brittle. In pigs: white, pink and white, soft, oily friction	Increased consistency, yellow	Matt, low texture
Bone marrow	Fills the medullary canal, pink-yellow, elastic, glossy in section	Elastic, yellow, fills the entire medullary channel, glossy in section	Soft, dirty-gray, retracted into the medullary canal, putrid smell
Joints	Joint surface is smooth, shiny. Small quantity of clear synovial fluid	Smooth joint surface. Small quantity of synovial fluid.	Areas covered with mucus.Abundant synovial fluid, cloudy, putrid smell.
Tendons	Glossy, resilient, hard	Pearly whites	Opaque, grey
Broth when boiled	Clear, aromatic, stars or islands of fat on the surface, pleasant smell and taste	Cloudy, with plenty of foam, without specific flavor of fresh broth	Cloudy, dirty, with floaters, rancid and moldy odor, no fat droplets are not observed on the surface

Tabel III. Organoleptic parameters of bread

Features	Sanitary requirements
Shape	Regular, unflattened, well grown
Crust **aspect** **color**	Smooth, shiny, unburned, without tears and cracks> 1 cm - without defects as burns, seams, patches, crustless parts, blisters, wrinkle - uncontested by insects, rodents - ruddy, uniform
Crumb **appearance in section, color and consistency**	An even mass, with fine pores, without gaps> 2 / 3 cm, no traces of flour lumps, without compact layers. Even, characteristic for the examined specimen elastic (upon slight pressure, returns to its initial form); Not broken, not sticky, with normal humidity; Not to stretch in thin silvery wires when breaking (sign of infestation with Bacillus mezentericus)
Smell	Aromatic, pleasant, characteristic with foreign odors (moldy, sour, etc).
Taste	Slightly sweet, moderately salty, typical, no sour or bitter taste - no mineral impurities or presence of foreign bodies

Practical lesson Nr 5

Date _____ /_____ /_____

Topic: ***Chemical composition and calculation of caloric value of the diet.***

The purpose of study:

_____

_____

Work report:

Repartition menu

The name of meals, alimentary products	Quantity (g)	proteins	fats	Carbo-hydrates	Ca	P	Vitam. C	kcal
Breakfast								
Totally for breakfast								
Supper								
Totally for supper								
Dinner								

Totally for dinner								
Totally per day								

Conclusion:

meals	**Caloric value (norm)**	**My dates**
Breakfast	30%	
Supper	30-40%	
Dinner	20-25%	

Recommendations:

Teacher signature_____

Practical lesson Nr 6

Date ______ /_____ /_______

Topic: ***Food poisoning and their prophylaxis***

The purpose of study:

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Work report:

Case problem____

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Conclusion: ____

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Teacher signature__________________________

Information note

FOOD HYGIENE

The main identified health risk factors in the world are: malnutrition, hypertension, unsafesexual practices, smoking, alcohol abuse, deficiencies in sanitation and water hygiene, iron deficiency,indoor pollution (smoke, CO, radon), hypercholesterolemia and obesity. It is noted thatmost of these factors are tied to individual eating habits .

For people to keep their state of health, it is very important that the food they eat brings all thenutrients the body needs in optimal amounts, and these foods are appropriate in terms of hygiene,are salubrious, not cause diseases. Food can suffer unwanted changes such as: impurification, alteration or contamination. Impurification is the presence of bodies foreign to the normal composition of foods, which do not cause diseases to the consumers, but a rejection reaction on their part. The alteration consists in modifying the organoleptic characteristics as a result of putrefaction, fermentation that occurs in foods, as a result of bacterial activity. Altered foods contain substances that can cause irritation and allergies if consumed. Contamination consists in changing the normal composition of the food and the presence of foreign components which may lead to illness.

Contaminated food agents may be: biological or chemical.

a. Biological agents are represented by: bacteria, viruses, molds, fungi or parasites.
Their source is represented by:
• the sick or carrier person and
• the sick or carrier animal.
From them, germs can spread in various ways (sneezing, coughing, feces, urine, meat, milk, etc.) in the environment (surfaces, machinery, water, food, etc). If they are stored, handled or prepared in unhygienic conditions, the food can receive different germs. Insects and rodents have an important role in transporting germs. Those who eat contaminated food can get various diseases: food poisoning, epidemic hepatitis, trichinosis, etc.

b. chemicals that can contaminate food may belong to the following categories:
• pesticides
• veterinary drugs,
• food additives
• natural toxins
• substances from machineries, packaging, washing etc.

Chemically contaminated food consumption may lead to consumers illness such as poisoning, mutations, allergies, cancer etc.. In order to prevent the occurrence of diseases due to unhealthy eating, there are some rules that should be respected by the food units regarding the construction, equipping and transmission,

- **Food poisoning (infection) = a disease occurred by eating germ contaminated food, that causes fever and gastrointestinal symptoms.**
- **Food poisoning (intoxication) = a disease occurred by eating food contaminated by chemicals (pesticides, additives, excess heavy metals), by natural toxins (mushrooms, fish, poisonous plants, HPA) and mycotoxins (of grain) that does not initiate fever or gastrointestinal symptoms, and that does not have an antidote.**

The prophylaxis of food-borne diseases is made by: prevention through health control measures, health education and / or coordination of services for human health, veterinary and consumer protection.

Preventive measures in food quality control:

- **Measures targeting the reservoir (source) of contamination**
- **Measures targeting the food**
- **Measures aimed at people who come into contact with food**
- **Measures targeting the consumer.**

Foods vary according to the chemical composition, the degree of digestion, the mode of action on the human body, aspects that must matter in the curative diet composition, and the development of optimal methods of culinary products processing. Food is characterized by nutritional, biological and energy values. The nutritional value is a generic concept that includes the energy value of the product, the content in nutrients and the degree of assimilation by the organism, and the organoleptic properties.

The nutritional value is higher in products whose composition corresponds to the principles of balanced nutrition, and products that serve as a source of essential food substances (absolutely necessary). Energy value is determined by the amount of energy that is released by the nutrients of the product (proteins, fats, assimilable carbohydrates, organic acids). The biological value primarily reflects the quality of proteins in the product, their amino acid composition, the degree of their digestion and assimilation by the body. In a broader sense this includes the content of the product in other life important substances, such as vitamins, trace elements, indispensable fatty acids. Food quality is the amount of properties that determine their usefulness to meet certain needs in accordance with their indication.

Organoleptic properties of the products are characterized by the appearance, texture, color, smell, taste. The changes in the organoleptic qualities of the product, usually indicate the worsening of the biological value (reduction in vitamins, indispensable fatty acids content) and the possible accumulation of degradation products of proteins, carbohydrates, the oxidation of lipids. This may exert a harmful action on the body, especially on sick people. The moldy products form toxic substances. For perishable products, alongside organoleptic changes, germ multiplication can also occur.

Considering the characteristic signs and the particularities of food products used, we can classify the following groups:

- milk and dairy products;
- meat, meat products, fish, canned food;
- eggs and egg products;
- cereals and their derivatives;
- vegetables and fruits;
- edible fats;
- sugar, honey and confectionery
- non-alcoholic and alcoholic beverages.

Products of the groups listed above are also divided by their origin or their obtaining mode.Some products are divided into types and categories in relation to the qualities they have, according to standards (Codex Alimentarius).

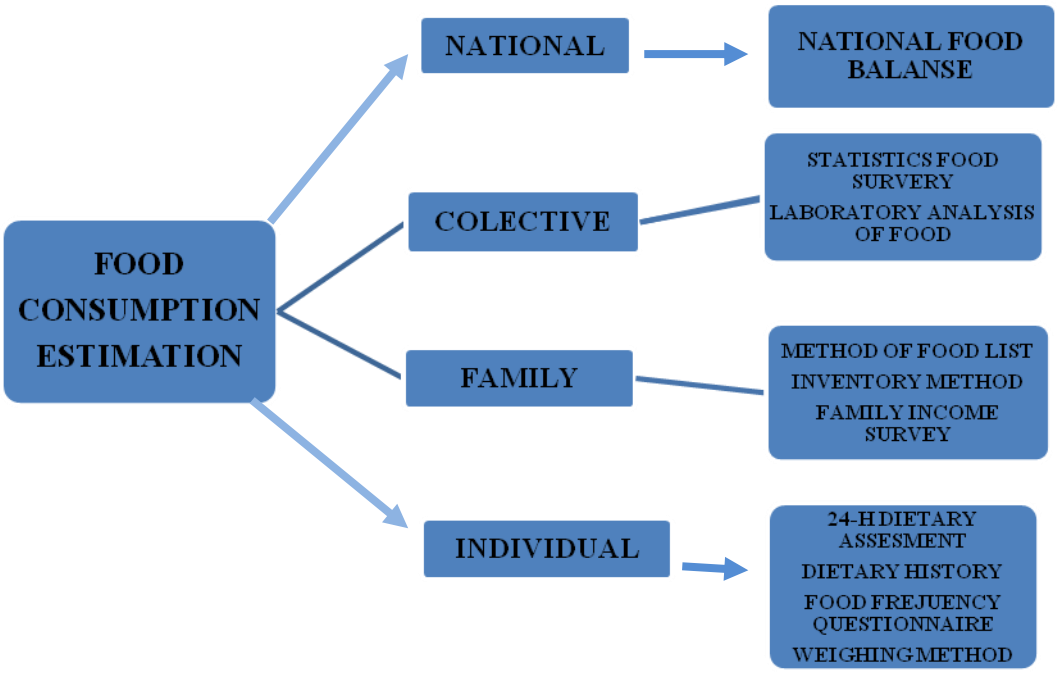

Figure 1. *Classification of food consumption investigation methods*

How does food become contaminated?

Food poisoning organisms can be spread and/or can develop to unsafe levels in the following circumstances:

- when poor food handling practices are followed, including lack of hand washing
- when food is touched by someone who has gastroenteritis
- by contact with pets, flies or other pests
- cross contamination between raw meat and ready to eat foods
- as a result of poor temperature control

How to protect your food

- Keep food covered to protect it from contamination (for example by dust, insects, sneezing).
- Keep raw food separate from cooked foods to prevent cross-contamination. For example keep raw meats in a sealed container and on a separate shelf to ready to eat foods in the fridge.
- Keep high-risk foods hot (above 60^{o}C) or cold (below 5^{o}C). Pathogenic bacteria grow best at temperatures between 5^{o}C and 60^{o}C.
- Always wash your hands thoroughly with soap and warm water before handling food.
- Use separate cutting boards and knives for each type of food (for example raw meat, fish, vegetables, cooked meat). Always clean and sanitise work surfaces and utensils to kill organisms.
- Most food should be cooked to a temperature of at least 75^{o}C. This can be checked with a thermometer. If you do not have one then check that meat is cooked until the juices run clear, not pink.
- Avoid handling food when you think you may have food poisoning.

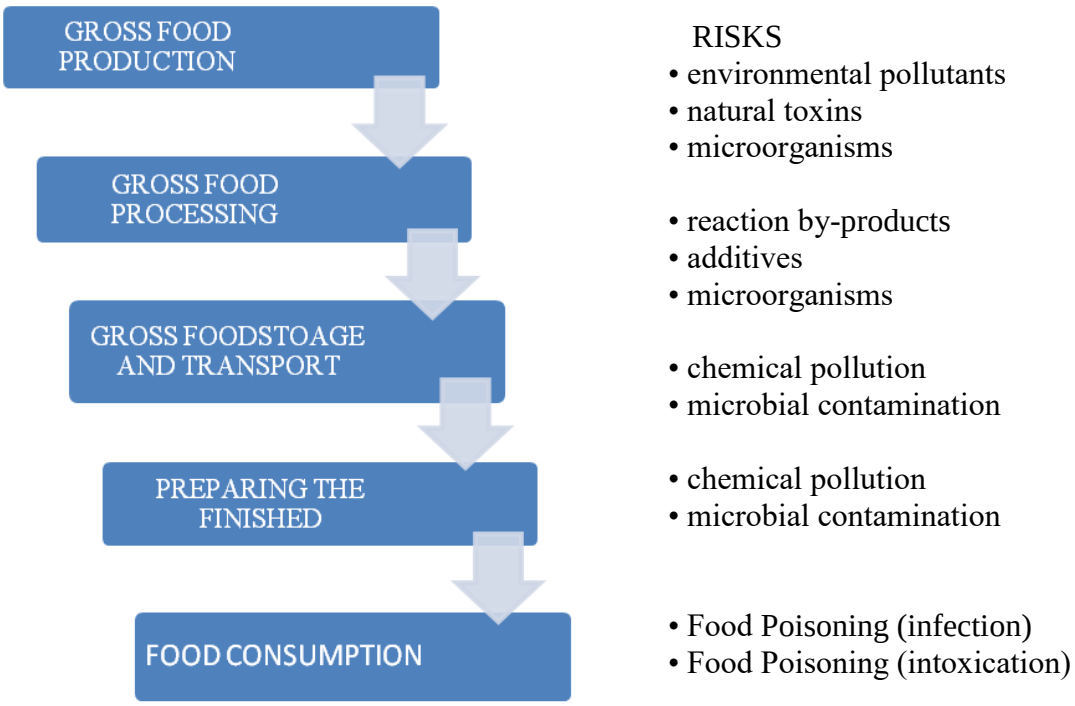

Figure 2. Food circuit diagram from production to consumption

Types of food poisoning

Food poisoning is a very common illness. For most people it is usually mild, but food poisoning can be severe and even deadly for some individuals.

Most cases of food poisoning occur when people eat food or drink water containing bacteria, bacterial toxins (substances produced by bacteria), parasites, or viruses, Food poisoning can also occur when non-infectious poisons (such as poisonous mushrooms) or heavy metals (such as lead or mercury) find their way into people's stomachs.

The following table details the symptoms and incubation period for some of the more common types of food poisoning organisms. The associated foods shown in the table have previously been found to be a source of that food poisoning organism. This does not mean that food poisoning organisms are always found in these foods or that they are always unsafe to eat. This table is for guidance only and medical attention should be sought to assist in the diagnosis of food poisoning.

Pathogen	Incubation period	Symptoms	Associated foods
Bacillus cereus	1 – 5 hours (vomiting) 10 – 13 hours (diarrhoea)	Nausea, vomiting Diarrhoea	Cooked rice, meat products, custards
Clostridium botulinum	12 – 36 hours	Blurred vision, difficulty in speaking, swallowing and breathing, nausea, vomiting, dry mouth, weakness, fatigue and ultimately paralysis.	Honey, home-preserved fruits, vegetables, potato salad, minced garlic in oil. Canned foods, meat, fish and soft cheeses
Clostridium perfringens	8 – 22 hours	Diarrhoea, abdominal cramps that last for about 24 hours.	Meat, poultry
Escherichia coli	2 – 8 days	Diarrhoea, abdominal pain, vomiting and fever.	Undercooked beef, unpasteurised milk, sprouts, contaminated water
Salmonella	8 – 72 hours (usually 12 – 36 hours)	Abdominal pain, nausea, diarrhoea, fever, vomiting and headache.	Raw chicken and meat, undercooked eggs, raw egg mayonnaise
Shigella	1 - 7 days (usually 1 - 3 days)	Diarrhoea (usually containing mucus and/or blood), nausea and vomiting, fever, stomach cramps. Lasts about 4 – 7 days.	Contaminated food, drink and objects. Person to person spread.
Staphylococcus aureus	1 – 6 hours	Nausea, vomiting, abdominal cramps and diarrhoea. Last for about 1 – 3 days.	Raw meat and poultry, cheese, cream, unpasteurised milk, processed meat

Practical lesson Nr 7

Date _____ /_____ /_____

Topic*: Hygienic evaluation of the microclimate of different rooms, inclusive and his impact on the human health.*

The purpose of study:

_____

Work report:

1. Determination of humidity in the room:

a) ***August*psychrometers:**

Absolute humidity (A = f-α (t-t_1) B)_____

Relative humidity,% ($R = \frac{A \times 100}{F}$, and after the tab)_____

2. Speed of movement of air currents in the room _____ m / s

3. Atmospheric pressure _____ mm Hg.

Height from the floor , m	temperature on the diagonal,ºC			temperature difference on the horizontal °C
	from the inner wall	the center of the room	the outer wall	
0,1				
1,0				
1,5				
temperature difference on the vertical				

Conclusions and proposals to improve the microclimate

_____

_____

Teacher signature_____

Information note

1. MEASUREMENT OF THE PHYSICAL PROPERTIES OF AIR

Air environments refer, in addition to ambient air, to the industrial, occupational air (indoor and outdoor), non-industrial occupational air (indoor and outdoor), non-occupational indoor air (household, study halls, shops, theatres, medical facilities) and the air inside the means of transport (cars, trains, planes). The microclimate refers to all the physical factors of air (temperature, humidity, air currents, heat radiation) which influence the heat exchange between the body and the environment. Among the physical properties we also include the atmospheric pressure, radiation and air electricity, which are not determining factors of the microclimate as they don't have a direct influence over the human thermal sensations. It is considered that the most favorable microclimate in the household is the one which requires a minimum activity of the thermoregulatory apparatus, both in healthy and ill persons. Small oscillations of the microclimate, within physiological limits have a positive role by stimulating the thermoregulatory capacity. Ample oscillations have adverse effects. Further on we present several techniques and measuring devices of different parameters.

1.1. Measurement of the air's temperature

Units

The temperature's measuring unit is the degree, which has different values depending on the used thermometric scale. Each thermometric scale has two constant points: the melting point of ice, and the boiling point of distilled water, at an atmospheric pressure of 760 mm Hg. The Celsiusscale (° C) is divided into 100 degrees. In France, the Reaumur (° R) scale is used, divided into 80 degrees, and in the United Kingdom, the United States and other Anglophone countries the Fahrenheit scale (° F) is used, divided into 180 degrees. The melting of ice from distilled water is recorded on the Reaumur and Celsius scale at 0 degrees, and on the Fahrenheit scale from 32. Water boiling occurs at 100 degrees Celsius or 80 degrees Reaumur, to 212 degrees Fahrenheit.

Instruments

The common thermometer is used to determine the thermal values between -30°C and 300°C,and the alcohol thermometer between -70°C and 120°C.7

The ordinary thermometers are: the room thermometer, bathroom thermometer, laboratory thermometer, etc. The special thermometers are: the medical thermometer, skin thermometer, the maximum and minimum thermometer, the thermograph. The medical thermometer measures thermal values between 35 – 42°C, and the skin thermometer between 20 – 40°C. The smallest changes in the thermal environment are recorded by the skin temperature, which is a highly sensitive physiological indicator.

The Maximum and Minimum thermometer (Six – Bellani) shows the maximum and minimum temperature in a given period of time. The thermograph records the air temperature, the resulting diagram being called a thermogram.

Temperature measurements

Temperature measurement must be made in several points and levels, to calculate a mean value, and to track variations in space and time. Also, it is indicated to repeat the measurement during the day.The outside air temperature is measured in the shade. The thermometer is placed at least 4 m from the walls and at 2 m above ground.

Sanitary regulations

The optimum average value is 18 to 22°C, in the summer not exceeding 26°C. Horizontally, the differences must not exceed 2 – 3°C and vertically, 1,5 – 2°C. Temperature variations within 24 hours should not be more than 4 – 6°C for heating stoves and 2 – 3°C for central heating. The comfort temperature is higher in hospitals (20 – 22°C), especially in certain wards, operatingrooms. On the other hand, it is lower when hard labor is involved (10 – 12°C).

1.2. Measurement of the air's humidity

The relative humidity (RH) indicates the degree of the air saturation. At the moment of saturation, a relative humidity of 100% is recorded. It is calculated by the ratio between the absolute and maximum humidity, measured at the same temperature and pressure:

$$\underline{\mathbf{RH = AH/MH \times 100}}$$

Measurement methods

The hygrometric method

The hygrometer consists of a metal frame, and continuously records the relative humidity by using the pointer, located in front of a graded quadrant, measuring values between 0 – 100%. The recording is in the form of a curve, called a hygrogram.

The psychrometric method

The instrument used to determine the humidity is called a psychrometer, the most often usedbeing the **Assman psychrometer.** The psychrometric method's principle consists in the

water's evaporation from a substrate. The humidity is deduced by determining the difference between the psychrometer's two thermometers, because the evaporation and cooling of the water found on the surface of the thermometer's wet tank depends on the humidity.

Sanitary regulations

The air's humidity is dependent on the external humidity, the degree of overcrowding in the house, the type of activities in the household. The optimum relative humidity is between 35 - 65%, with an average of 50%. Humidity should be lower as the temperature increases, to maintain a state of thermal comfort. Relative humidity should not go below 20 – 25% as it causes dryness of the mucosa. If the humidity is above 70 - 75%, it is considered that the air is damp.

Measurement of the air's movement

In the atmosphere, the direction of air currents is expressed by the cardinal point from where the wind blows. The wind direction can be estimated by simple observations (smoke direction, the direction of a tied flag, throwing grass, etc.), with the aid of a vane (a metallic cross fitted on a vertical axis) or the wind rose.

Measurement of velocity

Measurements are made using a katathermometer or an anemometer, an instrument used for measuring air flow at a speed exceeding 0.5 m/s. Anemometers can be static or dynamic. The signs are read at the beginning and at the end of the measurement, or directly in m/s.

Sanitary regulations

Air currents are permanently present in houses, due to human activities and movements, respiration, ventilation. The recommended air current speed is between 0.1 to 0.3 m/s, without exceeding 0.5 m/s. A higher speed becomes perceptible and produces a cooling of the body, especially when the air currents are cold.

Measurement of radiant temperature

The primary source of heat and light, for the Earth, is the solar radiations, which have an important role in heating and lighting up homes. Infrared rays from solar radiations determine the sensation of warmth. In living rooms, heat radiation sources are mild, and rarely cause negative effects on the people. For radiant temperature measurements, a device called an actinometer is used, which operates on the expansion effect of fluids.

Measurement of atmospheric pressure

The weight of an air column on a particular area represents the atmospheric pressure at that place. Air pressure is not a component of the microclimate, but is among the most important physical properties of air.

Measuring units

The unit for air pressure assessment is the atmosphere. The atmospheric pressure (one atmosphere) is the pressure equal to the weight of a Hg column, 760 mm in length, with a section of 1 cm2, at a temperature of 0°C, at sea level, and a latitude of 45°C. Atmospheric pressure can be expressed in bars, mbars respectively. An atmosphere corresponds to 760 mm of mercury (torr) – 1013 mbar.

Measuring tools

The barometers are the instruments used to measure atmospheric pressure.The mercury barometer is made of a sealed glass tube with the lower part opening into a mercury reservoir. The barograph is a device which records automatically and continuously the variations of atmospheric pressure. Atmospheric pressure values depend on height and the weather. Pressure decreases exponentially with height, and is lower compared to the value measured at the same height when the weather is dark and cloudy.

The estimation of thermal areas – Hill katathermometry

When the physical factors of the microclimate don't stress the thermoregulatory system, the body is in a state of thermal balance expressed in a state of comfort. The body's thermal comfort of discomfort can be appreciated either by determining the microclimate's physical factor complex (through the katathermometric method), or by exploring the physiological reactions of the body under the influence of these factors.

The effective temperature

The effective temperature is a relative value, obtained by appreciating the heat sensation produced by the combined effect of temperature, humidity and air currents on the body. The

effective temperature is marked with ET and is expressed in effective temperature degrees (ET°). The comfort zone is between 17,2 – 21,7° ET, and the comfort line is 18,1 – 18,9 ° ET.

Hill katathermometry

Through this method the air's cooling capacity is determined, which depends on the combined and simultaneous action of temperature, humidity and its movement. The Hill katathermometer is a specific thermometer with colored alcohol. Knowing the katafactor (F) and the time of descent (t), the air's cooling power (H), called the katavalue is obtained. It can be calculated with a simple formula:

$$\underline{H = F/t}$$

According to the katavalue, we can estimate the thermal areas. In the comfort zone, the dry katavalue has to be between 4 – 6, and the wet katavalue between 12 – 18.

Table 1. Estimation of thermal areas

	Dry katavalue	Wet katavalue
Warm zone	**<4**	**<12**
Comfort zone	**4 - 6**	**12 – 18**
Cold zone	**>6**	**>18**

The Hill katathermometer, the dry type, is also used to determine the lower velocities of air currents.

Practical lesson Nr 8

Date _____ /_____ /_____

Topic: ***Air pollution of the environment at the working place of dentist with chemical substances and dust. Determination of the chemical substances in air by means of express- methods.***

The purpose of study:

_____

_____

Work report:

1. Taking air samples methods are:
_____
_____
_____
_____
_____
2. Expres method of determining toxic substances in the air:_____
_____
_____
_____
_____
3. Conditioning of the air volume:
_____
_____
4. Methods of determining CO_2 principle of the method_____
_____
_____

Conclusions:_____
_____
_____
_____

Teacher signature_____

Information note

AIR POLLUTION BY DUST AND GAS

Air pollution is an important contemporary issue because of its negative impact on the population's state of health, creating a state of discomfort, affecting the flora and fauna, having a harmful effect on human life and its environment, which is why the importance of air pollution monitoring is emphasized.

Air pollution with particles

Dust or solid particles are one of the main elements of air pollution, both in industry and in the atmosphere of populated centers or homes.

Dust properties

The denomination of solid particles is complex. Air suspensions or aerosols represent pollutantsdispersed into the air as solid or liquid particles. Larger sized particles are also called dust.Size differs from the visible to the naked eye (mm) to those perceptible by electron microscope (0,001 microns). Particles with size above 10 μm are retained in the upper airways, those under 5 μm reach the alveoli and are retained in a high proportion (80-90%). Particles less than 0.1 μ, although they may reach the alveoli, are eliminated in great proportion with the exhaled air.

The particles' sedimentation capacity is determined primarily by their size. According to W.Gibbs, aerosols larger than 10 μm settle in the air with an evenly accelerated speed; aerosols withsizes between 10 to 0.1 μm settle with a uniform speed and partially diffuse in the air; aerosols with sizes between 0.1 to 0.001 μm do not settle, but diffuse strongly in a Brownian motion. Dust concentration in the air largely determines their degree of contamination, being the main defining element of adverse effect; the higher the concentration, the higher the health risk.
By their nature, the particles may be mineral or inorganic (metals and their compounds) and organic (plant, animal). By origin, the particles are natural and artificial. The chemical composition of the dust, in addition to their size and concentration, determines the aggressiveness of the suspensions. By their effect on the body, the particles can be divided into two main categories. The non-toxic have a nonspecific irritative action, and the toxic ones have a harming effect on the body due to their chemical composition. A few examples of toxic dust: dust of lead, zinc, chromium, silica, arsenic oxide,etc.

Collection of air samples

Dust collection and measurement by sedimentation

Through sedimentation only the larger particles are collected, which under the law of gravity are spontaneously deposited. Sedimentation containers, conventionally have a height of 25 cm, a diameter of 16 cm and a sedimentation area of 200 cm2. The collecting points are set to various distances around the source of contamination. The exposure lasts for 10 – 30 days, after which the containers are covered and brought to the laboratory. The result is expressed in measuring units: mg or g settled dust / 1m2 and a period of 30 days or a year.

Dust collection and measurement by aspiration

Compared to the sedimentation method, the dust collecting devices have a higher efficiency. These devices basically are made of an aspiration component (vacuum, pump, air ejector), afiltering material designed to retain the particles, and a flowmeter to measure the quantity of theaspirated air.

Quantitative measurements

The measurements must be made at characteristic moments, and the samples ought to be collected in different specific points. Besides the usual times and places of prelevation, a

frequency has to be established, as in the time frame when the measurements will be repeated. The most important *gravimetric methods* were already mentioned when collection of samples were described. After the collection by sedimentation, the sedimentation method can be applied, after the prelevation by aspiration, different gravimetric methods can be applied. The overall weight of the collected dust is determined by gravimetric methods, without knowing the number, the size and nature of the particle components, important elements to assess the harmfulness of the particles. That is why gravimetric methods must be completed by coniometric methods.

Coniometric methods are of several kinds. The sedimentation method on glass slides is a very simple one: the well-washed and degreased glass slides are being controlled microscopically, then exposed. After the exposure, for 5 – 10 – 15 minutes, the microscopic particles are counted. The average number of dust particles is related to the surface of the used glass slides. The Zeiss coniometer method is suitable and widespread method among coniometric measurements. The principle is based on the air aspiration using a pneumatic pump and the projection through a slot towards an impact surface located at a short distance from the slot's opening. Due to inertia, the dust particles are projected from the air flow and retained on the impact surface, which has an applied adhesive. The collection and retention of the dust is therefore made through impact, and the counting is made by using a complex microscopic device.

The Zeiss coniometer is a device composed of three main parts:

1. Suction pump – can be set for a given air volume: 1 cm3, 2.5 cm3, 5 cm3
2. Dust particle fixation chamber with a glass screen that has 30 collection fields
3. Microscopic device with an ocular micrometer network for counting the particles

Qualitative measurements

Measurement of dust particle size

Particle sizing is an important measurement because it contributes to the full appreciation of the dust's harm on the body. For accurate measurements the Zeiss coniometer is used. Dust examination is made at the microscope.

Measurement of the dust dispersion

Dispersiometry reveals the size of particles in the air, knowing that particles smaller than 5 μm, especially those less than 3 μm can enter the alveoli. It also reveals the dust's degree of hazard. Therefore, the more numerous particles under 5 μm, the higher the harmfulness of the dust. The coniodispersiogram is the graphic representation of the results regarding the dispersion degree of the dust. The number of particles is denoted to the "y" axis and their size to the "x" axis. It shows us that the dust is harmful to the body if a large percentage of the particles is under μm, so there is the possibility of them entering the alveoli. Instead, if relatively large particles (more than 5 μm) prevail, the dust is less harmful.

Measurement of the particles' chemical composition

The chemical analysis of powders aims to highlight the existing chemicals in the dust, such asiron, lead, silicon dioxide, etc. The presence of some of these substances provides an increasedharmfulness of the dust.

Measurement of silicon dioxide

Usually the content of free crystalline silicon dioxide is determined, indicating the degree of aggressiveness of dusts. The pathogenesis of dust increases in direct proportion to its content of free silicon dioxide. Several methods of measurement are known, they are based on a common principle: the powder's fractional attack with a chemical reagent which dissolves the silicates.The weight difference between two weighings represents the amount of SiO2 in the sample. The tetralin method is the most used physical method for the analysis of silicon dioxide. If the slide on which the dust settles is covered with tetralin, all SiO2 particles will disappear.

Measurement of lead and mercury

After adding dithizone, both in the presence of lead and mercury a stable, pink colored complex appears, in proportion with the quantity of metal in the sample.

Gas pollution

Among toxic gases that are of particular importance for the harm they cause, we mention carbon monoxide, nitrogen oxides, sulphur dioxide, chlorine gas and others.

Measurement methods

For the quantitative assessment of various toxics, fast guidance methods and automatedmethods are applied. Guidance methods are capable of quickly detecting the presence of toxic substances, and give an approximate indication of its concentration. These methods are always based on certain chemical reagents, which in the presence of the examined substance change their color. Automated methods use gas analyzers, devices that allow us to determine the concentration of one, or more components of a gas mixture. Using a pump, the air is aspirated and passed through a detector based on a particular physical of physic-chemical principle. There are several types of automatic gas analyzers. In many cases, the measurement of a toxic's concentration in the atmosphere, especially in a workplace, must be accompanied by the detection and measurement of the toxic, or its metabolism products in the exposed person's body. These measurements sometimes have more precise meaning than the concentration in the breathing air, being more faithful indicators of the degree of exposure to the toxic. The samples (blood and/or urine) should be collected under conditions that exclude both the outer pollution with the searched substance, and the loss of the sought out element.

Several toxic gases

The toxicity of a substance which pollutes the air as gas is related primarily to its chemical nature, thus to the toxic potential of the substance.

Carbon monoxide (CO) is a widespread pollutant with the highest discharge worldwide. It is a colorless, odorless, tasteless gas. It results from the incomplete combustions, the artificial sources come from burning fuels in motor vehicle engines, household combustions, industries, mines, smoking.

Sulphur dioxide (SO2) is a colorless, suffocating gas, with a characteristic pungent odor. The main sources are inferior coal or wood burning, different industries. In general, the increase of sulphur dioxide concentration in the atmosphere leads to an increase in the population's overall morbidity.

Ammonia (NH3) is a colorless gas, with a characteristic pungent odor and taste. It's water soluble, highly irritating to the mucosa. It is used in the fertilizer industry, in the preparation of nitric acid, plastics, etc.

Nitrogen oxides (NOx) act on the respiratory system without causing irritation. Nitrogen oxides come both from industrial sources and as a result of increased traffic. The toxicity of nitrogen oxides is very high, and experts consider it higher than carbon monoxide's. Exhaust gases have in their composition several toxic gases: carbon monoxide, nitrogen oxides, sulphur dioxide, polycyclic hydrocarbons, benzpyrene, lead, aldehydes, benzens, soot, etc. Sample collections for analysis is made with the aid of semi-automatic devices or by the classical absorption method in previously chosen points – street intersections or along streets with heavy traffic.

Sanitary regulations

Maximum admitted concentrations

According to the republican rules, the concentrations of dust and gas in the atmosphere arecompared with the maximum admitted concentrations (MAC) The concentration in the air is usually determined by the mg/m3 unit. Gas (vapors) can be determined in parts per million (ppm), cm3/m3.

***The maximum admitted concentrations* (MAC)** can be defined as the dose of pollutants that donot cause direct or indirect harming effects on the human body. They are determined so as to bebelow the acute and chronic acting threshold, below odor and irritative perception.

The momentary maximum admitted concentration is used to determine the concentration ofpollutants short term, and the sample collection time is 30 minutes.

The maximum average concentration per 24 hours is used to determine the concentration perday, collecting the samples continuously or discontinuously, in several rounds.

Average monthly* or *annual values can be calculated.

Limit values

Under the new EU requirements, the maximum admitted concentration for particles in suspension for inhabited areas has been reduced to 50 μg/m3 PM 10, and the annual value to 20 μg/m3 PM 10. The public administration order nr.592/2002 provides limit values in the ambient air for the protection of health:

Sulphur dioxide – 125 μg/m3

16 Nitrogen dioxide – 200 μg/m3

Carbon monoxide – 10 μg/m3

Benzene – 5 μg/m3

Lead – 0,5 μg/m3

The order nr.448/2007 refers to the approval of the standard assessments for arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in the ambient air.

Practical lesson Nr 10

Date _____ /_____ /_____

Topic: ***Hygienic evaluation of the natural and artificial illumination in different rooms.***

The purpose of study:

_____

_____

Work report:

Hygienic appreciation of the natural illumination:

- Configuration of windows _____
- Orientation of windows is _____
- Distance between two windows is _____
- Distance from the floor and window is _____
- Distance from the ceiling and window is _____
- Distance from the floor and top of window is _____
- Surface of window is _____
- Coefficient of penetration is _____
- Coefficient of luminosity is _____
- Coefficient of natural illumination is _____
- Coincidence angle is _____ grades
- Opening angle is _____ grades

Hygienic appreciation of the artificial illumination:

- Reflection coefficient from the wall is _____
- Reflection coefficient from the table is _____
- Uniformity coefficient is_____

Conclusion: _____

_____

_____

_____

_____

_____

Teacher signature_____

Information note

THE HYGIENIC AND SANITARY ESTIMATION OF LIGHT RADIATION

Out of all electromagnetic waves, the eye detects those with the wavelength between 400 and760 nanometers (nm).

Light radiations (visible) sources:
Natural: natural light comes from the sun, which represents the most powerful and physiological source. Natural light is a polychromatic complex, a combination of 7 monochromatic colors, with decreasing wavelength from red to orange, yellow, green, blue, indigo and violet, their quantitative proportion being different (it is maximum in yellow-green, which is why the eye has the maximum sensitivity for these colors). The combination of the 7 colors leads to the "white" light.
Artificial: electric lighting with incandescent lamps (they create light with a dominant yellow component; are less economic) and fluorescent lighting (the emitted color depends on the lamp's structure).
The properties of lighting and the eye function
The main trait of light radiations (LR) is the released energy at the retina's sensitive cells level, energy which determines biochemical reactions of rhodopsin, and creates the sensation of light. The physical parameters of LR which influence the fundamental functions of the eyes are: the quantity, quality and uniformity of light. An inappropriate lighting (either insufficient, or excessive) conditions the capacity of the 4 main functions of the eye: acuity (the property to clearly distinguish the object's details); the perception's speed of small objects and details; clear vision stability; contrast sensitivity (the ability to see objects differ slightly from the background they were projected on). Other visual functions influenced by the level of lighting, are: chromatic perception (the ability to differentiate colors) and movement perception (the ability to distinguish moving objects). Illuminance is the luminous effect created on a surface or an object, both by the photometric traits of the light sources (luminous flux, light intensity, brightness) as well as the absorption or reflection capacity of the surfaces on which the luminous flux falls. The luminous effect has as unit of measurement the lux (lx). It represents the even spreading on a $1m_2$ surface of a 1 lumen luminous flux, coming from a standard source of 1 candela, located at a distance of 1m.

Illuminance assessment methods
Can be divided in two categories:

• methods which assess the natural illuminance in the rooms based on structural parameters 23 (factors and angles)
• methods which assess both natural and artificial illuminance.

Assesment of natural illuminance

Natural illumination depends on a series of factors: the general climate of the town, the season, the height of the sun above the horizon, the transparency of the atmosphere, the reflection ability of the environment, the distance between buildings, the obstacles in front of windows, the placement of buildings according to the cardinal points, the shape and placement of windows, their size and transparency, the depth of the room, wall color, interior design. Natural light intensity has high diurnal and seasonal variations.
Structural parameters are divided in factors and angles.
Used *factors*:
Luminosity coefficient or light ratio (LR) represents the ratio between the glassy surface of windows and the surface of the room;
LR = total surface of windows (m_2) / floor surface (m_2)

Sanitary standards:

1/3 => laboratories and drawing rooms;
1/4 - 1/5 => classrooms, operating rooms, delivery rooms, emergency rooms, therapyrooms;
1/5 – 1/6 => surgery, sterilization rooms, wards;
1/6 – 1/8 => living rooms.

Room depth coefficient (DC) represents the ratio between the length of the room (from the window to the opposite wall) and the height from the floor to the upper edge of the window.

Sanitary standards

DC = maximum 2;
The window's upper edge must be at most 30 cm under the ceiling;
The lower ledge must be 80 – 100 cm from the floor.
Used *angles*:

Incidence angle (IA) is the angle defined by two imaginary lines from the working point in the room, one is perpendicular on the window's plane, the other is oblique to the window's upper edge – the ABC angle. It should be 27°C minimum.24 The larger the angle, the better the illumination for the working place. Its size depends on the height of the window, and it is smaller as the measurement point is further from the window. The angle serves in the placement of working places in rooms with one sided illumination and to establish the limit depth of the room. If there is an obstacle in front of the window (building, tree, etc) the angle is divided in two other angles: the OA and the SA.

The opening angle (OA) is defined by two oblique imaginary lines from the working point in the room, one from the window's upper edge, the other from the obstacle's upper edge (or from a medium height if the obstacles in front of the window are at different heights) < ABE.
It should be a minimum of 5°.
The opening angle is the angle under which, you can see the clear sky from your work place. The larger the sector of sky seen from the working point, the wider the opening angle, and the illumination is better.

The shadowing angle (SA) is defined by two imaginary lines from the working point in the room : one to the upper edge of the obstacle in front of the window, the other one perpendicular on the window. The sanitary standard of SA (<DBC) is given by the trigonometric tangent of SA and it should be a maximum of 0.5 m.

Luxmetric assessment method of natural and artificial lighting

Luxmeter: the device's sensitive part is a phtotocell which is exposed to the area where the lighting level is measured, or it is oriented toward the light source. The light impresses upon the photocell and creates an electric current proportional to the luminosity.The intensity of the electric current is measured by a galvanometer graded in lux.

Method: the pointer of the device is brought to zero. After exposure, the reading is performed when the pointer has stabilized. For devices that have overlaping scales, the reading is performed starting from the smallest scale. When the indications of a scale are exceeded, the reading moves to the superior scale, thus establishing the scale more appropriate to the level of lighting. When the final scale is exceeded, a filter is placed over the photocell, which retaines a certain percentage from the light energy, in this case the value read on the scale is multiplied with the filter's retention factor.

Regulations:

- **Natural lighting in households : 50lx minimum;**
- **Natural lighting on work surfaces (writing, reading) : 100 lx minimum;**
- **Incandescent lighting on work surfaces (writing, reading) : 150 lx minimum**
- **Fluorescent lighting on work surfaces (writing, reading) : 300 lx minimum.25**

The given values for artificial lighting, 150 or 300 lx must be applied in : classrooms, study halls, libraries, laboratories, gyms and festivity halls. In drawing rooms the lighting should be 400 – 500 lx.

Lighting assessment parameters

Natural lighting coefficient (NLC) is the percentage ratio between the lighting of a certain point inside the room and a point outside, both points measured on the same horizontal, and expressed in lux.

NLC = number lux point inside/number lux point outside x 100

Natural light indexes are determined in the least lighted places in the room (example : the wallopposite of the window) and always at the working spaces in the room.

Sanitary standards:

- **minimum 1% in living spaces;**
- **minimum 2% în classrooms, laboratories, study halls;**
- **minimum 0,5% in auxiliary spaces.**

As the activity in the room requires a higher precision, the value of NLC increases.

Uniformity coefficient (UC): the work place must have an even lighting on its entire surface. Otherwise (increased light contrasts) overburdens the eye muscles and leads to early visual fatigue.

Reflection coefficient (RC) of surfaces and objects : is given by the ratio between the luxmetric value of the reflected flux and luxmetric value of the incident flux. The reflection coefficient of the table's working surface is 0.25. The coefficient is determined in natural and artificial lighting conditions.

Absorption coefficient (AC) measures the percentage of light absorption, as it passes through the window's glass.

AC = number of lux exterior/ number of lux interior x 100

***Sanitary rule*:** the window's glass must retain a maximum of 24% from the light.

Natural lighting. Hygienically speaking, this type of lighting is recommended especially because of its ultraviolet component (having a bactericidal effect on the bacterial flora in the air and on the work surfaces) and heat radiation (in the winter). It is recommended that living spaces should receive direct sun light at least 1 – 2 hours /day, in the shortest day of the year (the winter solstice).

An appropriate natural lighting in the rooms is ensured in the following conditions :

• the orientation of the house according to the cardinal points (for our climate zone the best one is : south, south-east or south-west)
• less obstacles in front of the windows (trees, hanging plants, enclosed balconies, drapes, blinds, etc) ;
• the upper edge of the window to be as close as possible to the ceiling (30 cm maximum) ;
• LR = 1/8 – 1/10 ;
• DC = maximum 2 ;
• IA = minimum 27°
• OA = minimum 5° (the area where the direct sunlight enters the room)
• NLC – minimum 1%

Artificial lighting: hygienic, can be ensured only if the artificial light sources emit an evenlighting, without causing any shining, flickering, shadowing, color modifying effect ; it shouldnot heat the air and should ensure a light spectrum as close as possible to the natural lighting.In the exploitation of lighting systems the normative stipulations will be taken into account regardingthe verification of electric appliances, the replacement of used lamps (at most 3 months),the periodical cleansing of lamps (the globes will be washed weekly) ; maintaining the reflectingsurfaces (windows, ceiling, walls, furniture) in a permanent state of cleanliness.In addition, achieving a good lighting also requires certain colors for walls, surfaces, objectsin the room (bright colors have a higher reflection coefficient, leading to relaxation and rest, anddarker or stronger colors induce a state of nervousness, fatigue.

Color of the walls :

• White : reflects up to - 80% of natural light
• Bright yellow : reflects up to - 50% of natural light
• Blue : reflects up to - 25% of natural light
• Light brown : reflects up to - 15% of natural light