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HYGIENE IN CHILDREN AND ADOLESCENTS

Tutorial

**Tomsk SSMU Publisher
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The tutorial on Hygiene is prepared in accordance with the Federal State Educational Standard of Higher Professional Education, for medical students. The textbook includes the main topics for practical classes on "Hygiene in children and adolescents" and reviews methods for measurement and evaluation of physical development of children and adolescents; hygienic requirements for territorial location, land plot and interior building construction of pre-school and school educational organizations; hygienic requirements for school furniture, teaching aids and children's toys. In presenting the material, the current regulatory documents – State Standards, SNiPs and SanPiNs were used.

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ГИГИЕНА ДЕТЕЙ И ПОДРОСТКОВ

Учебное пособие

**Томск Издательство СибГМУ
2019**

УДК

Кавешников В.С., Андропова Т.В., Гудина М.В., Одинцова И.Н.,
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Учебное пособие подготовлено по дисциплине «Гигиена» в соответствии с ФГОС высшего образования и предназначено для студентов, обучающихся по основным профессиональным образовательным программам высшего образования – программам специалитета по специальностям «Лечебное дело». В пособие включены основные темы практических занятий по разделу «Гигиена детей и подростков»: методы исследования и оценки физического развития детей и подростков; гигиенические требования к земельному участку и внутренней планировке здания дошкольного образовательного учреждения и школы; гигиенические требования к школьной мебели, учебным пособиям и детским игрушкам. При изложении материала использованы действующие нормативные документы – ГОСТы, СНиПы и СанПиНы.

УДК

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1. PHYSICAL DEVELOPMENT OF CHILDREN AND ADOLESCENTS, METHODS OF MEASUREMENT AND ASSESSMENT

Purpose of the lesson: is to familiarize students with the main indicators, methods of measurement and evaluation of the physical development of children and adolescents.

Indicators of physical development of children and adolescents.

Physical development is a set of morphological and functional properties of the body that characterize the process of its growth and development. Physical development is one of the leading indicators of the health status of children and adolescents and depends on many factors: heredity, climate, nutrition, care of the child, fulfillment of the basic regime aspects, physical education and other factors.

Observation of the physical development of children and adolescents is integral part of the work of the doctor of any children's institution. Detailed assessment of indicators characterizing physical development should be carried out during medical examinations along the entire period of growth and development.

To assess the physical development of children and adolescents use the following indicators:

- 1) Somatometric
- 2) Somatoscopic
- 3) Physiometric

Somatometric studies are conducted in a naked child in a warm room in the morning, as by the end of the day the body length is reduced by 0.5–1 cm, and the body weight is increased by 0.5–1 kg. These include measuring body lengths, diameters, body circumferences, specifically of the head, limbs and chest.

Body height characterizes the state of plastic processes in the body, reflects the dynamics of bone maturity and is one of the biological development indicators.

To measure the body length of a toddler baby, he/she is laid on his/her back so that his/her head densely touches the transverse fixed plate of the length gauge. In this case, the head of the child should be in such a position that the lower edge of the orbit and the upper edge of the tragus of the

ear are in the same vertical plane. The head of the child is tightly fixed, the legs are straightened by lightly pressing the palm of the left hand of the doctor on the knees, and the right hand is brought the movable bar of the height meter tightly to the heels, bending the feet to the right angle to the shins. The distance between the fixed and movable bars is the same as the height of the child (Fig. 1).

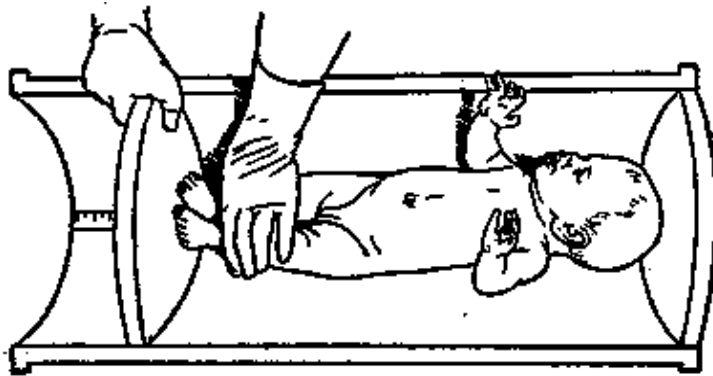


Figure 1. *Body length measurement of a toddler age child*

The height of a child of an older age is measured standing or sitting with a wooden height meter or a metal anthropometer. The wooden height meter is a 2 meter-high stand, fixed on a solid platform (Fig. 2a, 2b).

A coupling with a plate moves around the counter. To determine the height of a child sitting there is a folding bench. When measuring height, a child stands erect, with hands down, heels together, toes apart. At the same time, he/she touches the vertical stand with the heels, buttocks and interscapular spinal area. The head is not required to touch the rack. The head is set in such a position that the lower edge of the orbit and the upper edge of the tragus of the ear are in the same horizontal plane. The bar of the height meter is lowered to the highest point of the head. The count is from the base of the height meter, the measurement accuracy is 0.5 cm.

While only height can be measured by a height meter, another device – anthropometer allows measurements of different body distances – length of trunk, limbs, etc. An anthropometer consists of four hollow metal tubes, inserted into each other in accordance with the ruler scale; the length of the anthropometer is 2 meters. At the end of the upper tube, the clutch with a metal ruler is fixedly fixed, the second clutch with a cutout through which the divisions are visible can freely move along the rod of the device. The ruler is inserted into this coupling with the oblique end upwards (Fig. 2c).

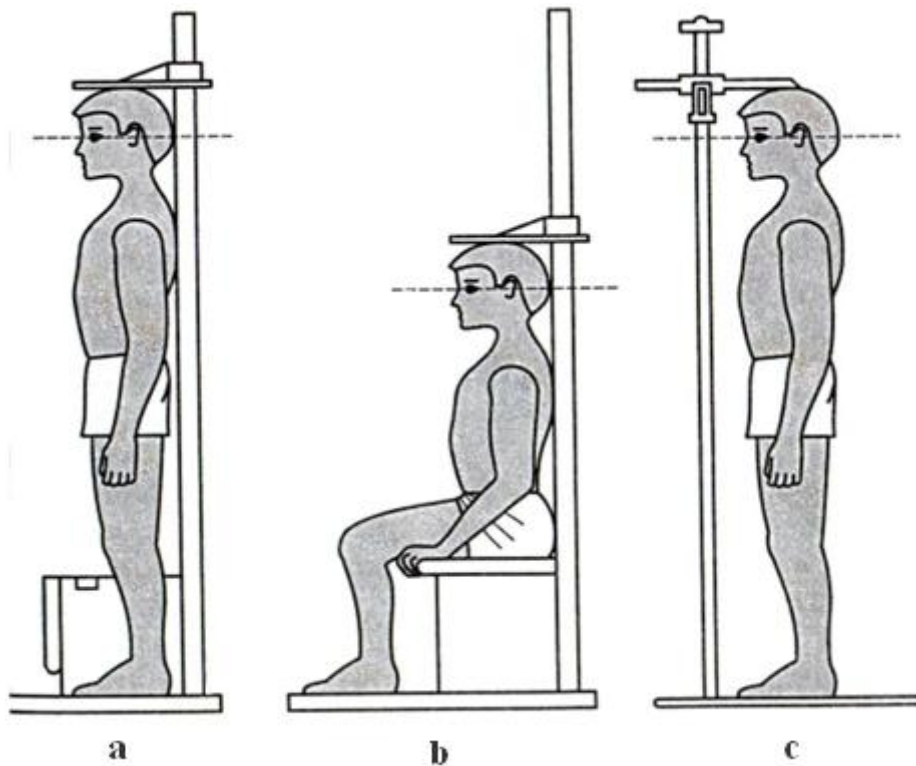


Figure 2. Measurement of height with a height-meter: *a* – standing, *b* – sitting; *c* – using an anthropometer

When measuring height, the person is surveyed in the same position as in the measurement with the height-meter, but the anthropometer is placed in front of the body, and the ruler of the movable clutch is lowered to the upper point of the head. The result of the measurement is indicated on the upper edge of the cutout of the coupling on a scale going from bottom to top. With the help of a metal anthropometer, you can also determine the length of the trunk and limbs, for which anthropometric points are used: for example, when measuring the length of the arm, use the humeral and finger points.

Body mass reflects the total development of the musculoskeletal system, subcutaneous fat, internal organs, as well as amount of fluid in the body. For weighing medical weighing-device, which must be adjusted before weighing, is used. Weighing is carried out on an empty stomach, without clothes and shoes. The examinee is placed in the middle of the weighing area.

Measurement of circumferences is carried out with a usual centimeter tape. The circumference of the chest is the most frequently measured parameter. It characterizes the volume of the body, the development of tho-

racic and dorsal muscles, and the functional state of thoracic cavity organs. Often it changes in accordance with the body weight. Determine chest circumference in a state of calm breathing, maximum inhalation and exhalation. The tape is applied behind the lower scapular corners with the arms raised. Then the hands are lowered: the tape, slipping, lies under the corners of the scapula. In young men and children of younger age the tape should pass in front along the edge of the breast nipple circle, and at girls above the breast. The difference between the chest circumference values at maximum in- and expiration is called a chest excursion rate.

Somatoscopic examination. As a result of the external examination, descriptive signs are obtained, which are often estimated by a three-point system. Weak development of the trait – 1 point, the average development of the sign – 2 points, expressed or high development – 3 points.

On examination, attention is paid to the state of the skin and mucous membranes (color, turgor, moisture), degree of fat loss, condition of the musculoskeletal system (type of skeleton, chest shape, posture, the shape of the legs and feet), development of muscles, secondary sexual characteristics, and also the doctor performs a dental examination.

Condition of the musculoskeletal system. There are three types of skeleton: *thin* (1) – characterized by narrow shoulders and chest, small sizes of hands and feet; *wide* (3) – broad shoulders, chest, large sizes of hands and feet; *middle* (2) – occupies an intermediate place. The spine performs the basic support function. To determine the shape of the spine, examine it in the sagittal and frontal planes, determine the shape of the line formed by the spinous processes, assess the symmetry of the shoulder blades, the level of the shoulders, the waist triangles (formed by the waist line and the lowered arm). Normally, in the sagittal plane, the spine has *physiological curves* – the cervical and lumbar; in the frontal plane a spine looks like a straight line.

Curvatures of the spine are possible to go beyond normal in both anterior-posterior and lateral directions. The shape of the spine determines posture – the habitual posture of a person who is at ease.

In case of anterior-posterior direction, the cervical over-flexure (with a stooped posture), lumbar (with lordotic), both bends (kyphotic posture) can be found, or both bends may be flattened (straightened posture) (Fig. 3).

Each length of the spine has its own values of the depth of the cervical and lumbar bends. With proper posture, the depth of the cervical and lumbar flexures in the younger school age varies within 3–4 cm, in the middle and older ages 4–4.5 cm. The body is held straight, the shoulders are straightened at the same level, the legs are straight (Fig. 4).

The over-curvature of the spine in lateral direction is called scoliosis. The over-curvature can capture the entire spine (full) or a part of it (partial). Depending on the direction of the arc, it can be left-sided, right-sided, S-shaped (Fig. 5).

I degree of scoliosis – functional disorder, non-fixed defect, disappears with active muscular tension.

II degree of scoliosis – persistent over-curvature, does not disappear with muscle tension; yet pronounced deformations of the spine and thorax are absent.

III degree of scoliosis – pronounced fixed over-curvature of the spine and deformation of the chest.

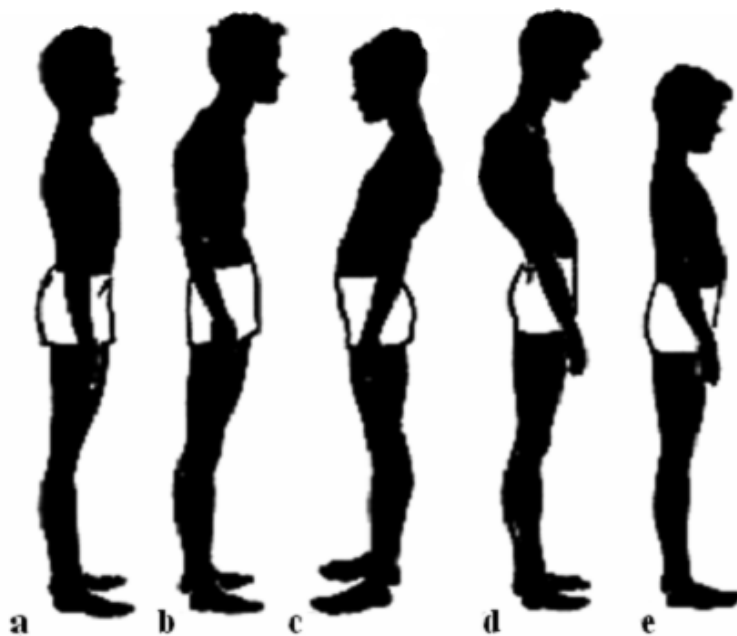


Figure 3. *Types of posture: a – normal, b – stooped, c – lordotic, d – kyphotic, e – flattened*



Figure 4. *Measuring the depth of the cervical (a) and lumbar (b) curves*

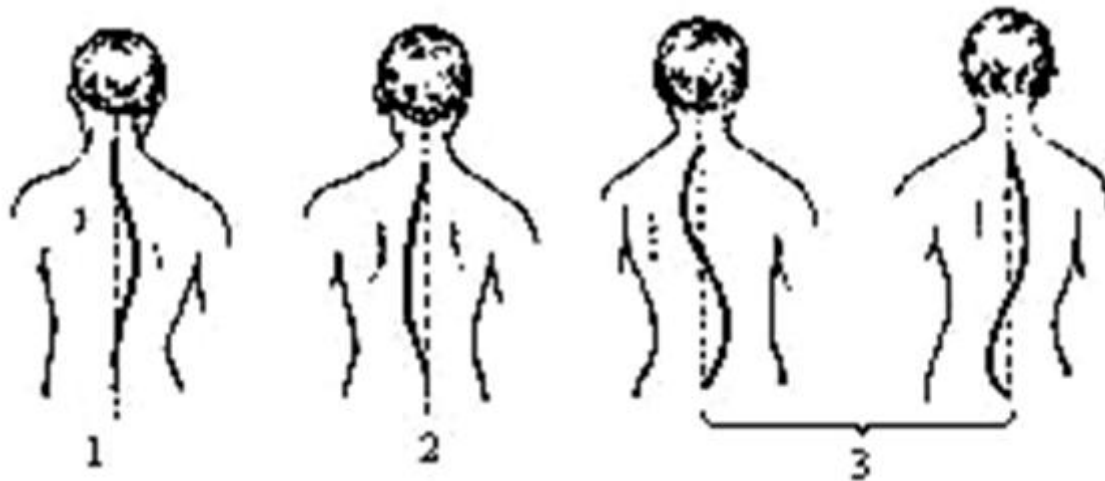


Figure 5. *Types of scoliosis: 1 – thoracic; 2 – common left-sided; 3 – S-shaped*

Shape of the chest is determined when looking at the profile and full face, paying attention to the magnitude of the epigastral angle, the direction of the lower ribs, the shape of the line that delimits the thorax from the front, the ratio of the anterior-posterior and lateral diameters. There are cylindrical, flat, conical and mixed forms of the thorax. There are abnormal forms of the chest so called "chicken chest" (narrow, stuck out sternal forward), "cobbler's chest" (hollow stump) and other deformities and asymmetries.

When determining the shape of the legs, the subject puts his/her heels together and stands erect. In normal form, the legs touch the knee joints, with the O-shaped form they do not touch, in the X-shaped form, one knee joint goes behind the other, and when the knee joints touch, the inner ankles are spaced apart.

The foot can be normal, partially flattened and completely flat. To determine the shape of the foot, foot prints are made (plantography). To accomplish it the doctor moistens the foot with the methylene-blue solution (or another colorant) and puts the child on a clean sheet of paper. The print is dried and analyzed.

For examinations of preschool age and schoolchildren, evaluation of the plantogram by the methods of Jaralov-Jaraljanc and Streeter is used.

According to the Jaralov-Jaraljanc method, the conclusion about the state of the foot arch is made on the basis of analysis of the position of the two lines drawn on the foot print (Fig. 6). The first line connects the mid-

dle of the heel with the second interdigital space; the second line, drawn from the same point, passes to the middle of the base of the thumb.

The normal foot is characterized by a moderate height of the plantar arch: the supporting surface occupies less than 1/3 of the whole plantar surface; the contour of the footprint in the middle part does not overlap the lines drawn from the middle of the heel. When the foot is flattened, the first line is located inside the imprint; with a flat foot both lines are located inside the contour of the footprint (Fig. 6).

Using the Streeter method, the tangent to the most prominent points of the inner edge of the foot is drawn on the resulting print. From the middle of the tangent, the perpendicular is restored to the outer edge of the foot (Fig. 7). Then, calculate the percentage of the length of that part of the perpendicular that passed through the imprint (a), to its entire length (a + b). If the isthmus is up to 50% of the perpendicular length – the foot is normal, 50–60% – flattened, over 60% – flat.

Examine the foot in all children of 2 years old and older. The diagnosis of flat foot can be made, starting from the age of 6 years.

Degree of muscle development can be judged by the contour, elasticity of the muscles, position of the scapula and the shape of abdomen.

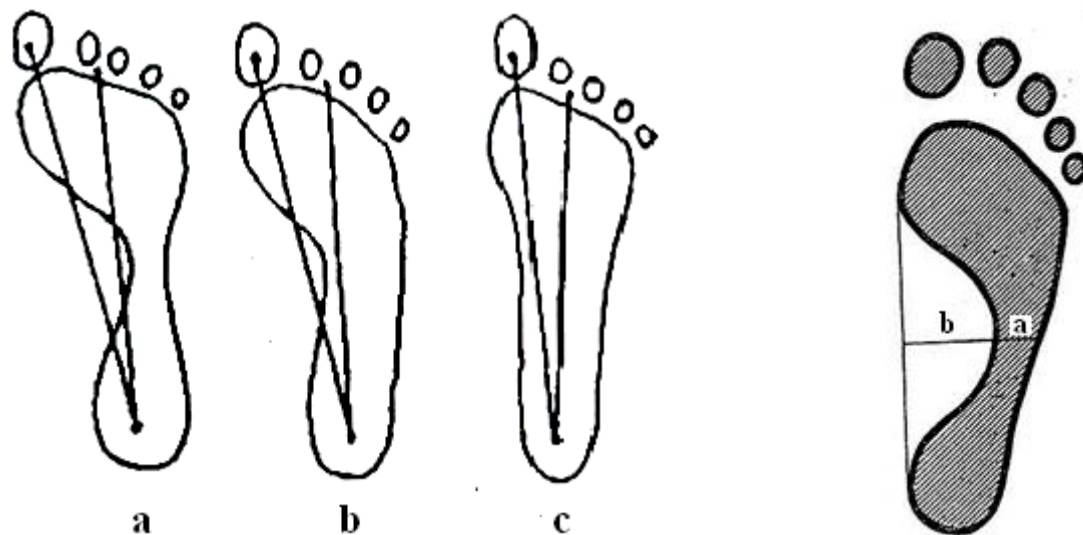


Figure 6. Evaluation of the plantogram by the Jaralov-Jaraljanc method: a – normal foot; b – flattened; c – flat

Figure 7. Determination of the foot shape by the Streeter method: a – the width of the isthmus; a + b – the foot width

Development is considered weak (1), if the contour of the muscles is not expressed, their elasticity is lowered, the lobed shoulder blades are observed, and abdomen is saggy. With good (3) development of the body, the contour is expressed, the muscles are elastic, the angles of the scapula are tightened, and the abdomen is tightened. However, until the age of 7, due to the lack of development of abdominal muscular corset and the muscles of the back, children cannot control abdominal muscular tension by will in sufficient manner.

Condition of the musculoskeletal system of children is sensitive to such factors as nutrition, motor conditions, furniture, clothing and footwear adequacy, hygienic conditions.

The fat loss degree is determined by the expression of bone contours and thickness of the subcutaneous fat layer. With a small (1) fat deposition, the bones of the shoulder girdle and the ribs are clearly contoured; the fold of the skin drawn on the side wall of the abdominal area with subcutaneous fatty tissue is thin and creates the impression of a lack of fatty layer. With a large (3) fat deposition, the bony relief is smoothed, the contours of the body are round, the skin folds are more than 2 cm.

Measurement of skin-fat folds is performed with the help of a special caliper device (Fig. 8). The thickness of the skin-fat fold is measured on the right side of the body at the four standard points: 1) at the level of the middle third of the shoulder over the biceps and triceps muscles, 2) at the level of the lower corner of the right scapula, 3) in the right inguinal region 2 cm above the middle of the inguinal ligament, 4) at the level of the navel. The researcher grasps the area of the skin with two fingers of the left hand: on the limbs 2–3 cm, on the trunk up to 5 cm, without causing painful sensations in the subject, slightly pulls it and applies the caliper legs to the fold formed, fixing the thickness of the fold. The average thickness of the skin-fat fold is calculated.

The degree of puberty is determined in boys from 10 years, in girls from 9 years on.

In boys, puberty begins with a change (mutation) in the timbre of the voice (Vox), then pubic hair (Pubis) develops, followed by increase in the thyroid cartilage of the larynx, development of the axillar (Axillaris) and facial (Facies) hair.



Figure 8. *Caliper*

In girls, puberty begins with the development of the mammary glands (Mamma), later pubic (Pubis) and axillary (Axillaris) hair appears. The leading criterion for the puberty of girls is the development of menstrual function (Menses).

After evaluation of the secondary sexual characteristics expression, the sexual formula is recorded. In boys, the stage of development of the pubic hair (P_{0-4}) and the stage of development of the hair in the armpits (Ax_{0-3}) are most often evaluated; in girls beyond these two indicators the stage of the mammary glands development (Ma_{0-4}) and presence of regular menses (Me+) is recorded.

Examination of teeth and check up of the dental formula is carried out in preschool children and younger schoolboys. Appearance of infant teeth begins at 6–8 months, in the absence of pathology, the baby's teeth set is formed by the age of 2 years and consists of 20 teeth: 2 incisors, 1 canine, 2 molars on the right and left on each jaw (Tab. 1).

Constant teeth begin to erupt from 6–7 years. By the age of 13, the bite shape is formed, consisting of 28 permanent teeth: on the upper and lower jaws on the right and on the left, respectively, 2 incisors, 1 canine, 2 small molars, 2 large molars. Third molars erupt between 17 and 21 years, and often even later. The corresponding infant and permanent teeth do not differ in shape from each other, but the “milk” teeth are smaller in size and, by the time they complete their resorption, they have erased incisal edges and chewing surfaces. The incised permanent teeth are characterized by the presence of denticles along the edge of the incisors and pronounced tubercles on the surface of the small and large molars.

Table 1

Timing of eruption of infant and permanent teeth

Teeth	Terms of teething	
	baby teeth	permanent teeth
Internal Cutter	6–8 months	7–7.5 years
External Cutter	7–9 months	8–8.5 years
Fang	15–20 months	11–11.5 years
The first small indigenous	–	10–10.5 years
The second small indigenous	–	11–11.5 years
The first great indigenous	12–15 months	7–7.5 years
The second great indigenous	20–24 months	12–12.5 years
The third great indigenous	–	18–25 years or later

Physiometric studies – determination of the body's functional parameters. The indicators most commonly used in hygiene are the strength of the arms, the strength of the body, as well as vital capacity of the lungs (VC).

The muscular strength of the hands (reflects the degree of musculature development) is measured with a hand dynamometer (Fig. 9). The examinee is standing straight, pulling the straight arm to the side and, working only with the arm, maximally compresses the dynamometer. Produce 2–3 measurements, record the highest value (in kg). The age indices of the muscular strength of the hands are given in Table 2.

The body force is measured by a steel dynamometer (Fig. 10). The examinee stands with two feet on the platform, bends down, takes hold of the handle of the dynamometer and tries to straighten with effort. In the initial position, the handle of the dynamometer should be at the level of the knees. Take into account the maximum result (in kg).

The *vital capacity* of the lungs (VC) is measured with a water or dry spirometer (the method is called “spirometry”). A dry spirometer is an air turbine consisting of impeller and other parts. The turbine receives a stream of air from the lungs of the person being examined. Under the pressure of the air jet, the impeller starts rotating, the rotation of which is transmitted through the gearbox to the arrow. The volume of the air ex-

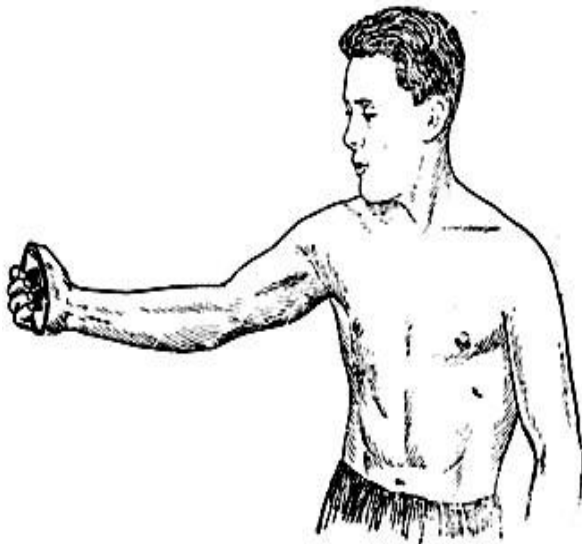


Figure 9. *Measurement of the muscular strength by a hand dynamometer*



Figure 10. *Measurement of the force by a steel dynamometer*

haled is determined from the position of the arrow. The scale of the spirometer is fixed to the lid and can rotate with it on the body.

Before the study, the spirometer scale should be set so that the arrow coincides with the zero scale division. The child is offered to take a maximum breath, hold his breath, tightly grasp the mouthpiece with his lips and through his mouth to exhale all the air. The study is carried out 2–3 times, the best result is recorded. The mouthpiece is disinfected. Age-specific indicators are shown in Table 2.

Physical development assessment. Evaluation of physical development is performed on the basis of comparison of individual indicators, characterizing degree of development of the child examined, with their average values for a given age-and-sex group of children, constituting regional standards. The regional standards for different indicators (height, body weight, chest circumference, functional indices, etc.) are obtained with regular (once in 3–5–10 years) cross-sectional (within 10–30 days) population-based studies of children's health in a given region. The children examined are divided in standard groups by age and sex (no less than 100–150 people in the group). The data obtained is subjected to further statistical processing in order to obtain average values and possible deviations from them. Individual indicators can be assessed only after determining the exact passport age of the child and thus belonging to a certain age group.

Table 2

Some physiometric indicators of children and adolescents*

Age, years	Vital capacity, ml	Arm force, kg	
		Left	Right
Boys			
4	900–1200	3.5–7.5	4.0–8.0
5	1000–1400	5.0–10.0	6.0–10.5
6	1200–1600	6.0–10.5	8.0–12.5
7	1300–1700	8.0–11.5	10.0–12.5
8	1375–1977	12.4–18.6	12.8–20.0
9	1428–2176	14.6–21.4	16.3–22.9
10	1640–2360	16.2–22.8	17.9–24.7
11	1820–2640	18.1–24.9	22.3–30.1
12	2100–2860	20.1–28.3	21.2–32.8
13	2070–3170	19.5–30.1	22.0–32.6
14	2573–3927	22.8–35.2	26.2–39.4
15	2941–4399	26.7–41.7	30.0–48.0
16	3540–4800	32.0–45.8	36.2–51.0
17	3539–4767	34.7–46.5	40.1–54.1
Girls			
4	900–1150	3.5–6.5	3.5–7.5
5	1000–1250	4.5–8.5	4.5–9.0
6	1150–1500	5.5–9.5	6.0–11.0
7	1250–1600	7.0–9.5	7.5–12.0
8	1194–1754	10.5–15.3	11.3–16.3
9	1273–1991	12.0–17.2	12.6–18.0
10	1494–2312	12.0–18.2	12.9–19.7
11	1736–2504	14.3–21.1	15.4–22.6
12	1788–2658	15.3–23.3	16.4–25.8
13	2183–3029	18.8–27.0	20.1–30.1
14	2234–3226	19.1–27.5	20.6–30.2
15	2589–3455	19.7–27.9	22.4–32.0
16	2593–3509	20.0–29.8	22.9–32.7
17	2661–3467	21.5–30.7	22.4–34.0

Note. * – Organization of medical control over the development and health of preschool and schoolchildren on the basis of mass screening tests and their improvement under conditions of a kindergarten, school (Methodical Manual, edited by GN Serdyukovskaya [1993]).

When determining the passport age of a child, the age grouping rules should be taken into account. Children of the first year of life are united in a group with an interval of 1 month. Consequently, the age group of children 1 month includes children from 16 days to 1 month 15 days, for 2 months they consider the age from 1 month 16 days to 2 months 15 days. From 1 to 3 years, the age group goes on quarter of a year basis, for example, children from 1 year 4 months 16 days to 1 year 7 months 15 days are classified as 1.5 year old. From the age of 3, the interval is 6 months, from 7 years – 1 year. For example, 3-year-old children include children from 2 years 10 months 16 days to 3 years 2 months 29 days. If in the region there is no possibility to establish standards for children from 3 years to 7 at intervals of 0.5 years, from the age of 3 it is possible to establish a group based on the annual interval.

Age grouping of children and adolescents from 3 to 18 years is presented in the auxiliary Table 3. Depending on the purpose of the study and the accuracy required, different methods of statistical processing are applied; therefore, different methods of physical development assessment are used in connection with this.

Method of sigma deviations. This method was extensively used since 20–40s of the last century. At present, the method of sigma deviations with a graphic representation of the profile of physical development is practically not used. However, it must be known for a better understanding of modern methods of assessing the physical development of children and adolescents.

The essence of the method of sigma deviations with a graphic representation of the profile is that the indicators of the child's physical development (height, body weight, chest circumference, etc.) are compared with the arithmetic mean of these characteristics (M) for the corresponding age-and-sex group taken from the table of standards. Standard tables are represented by the average arithmetic mean (M) of the physical development indicators (height, body weight, chest circumference), their mean errors (m), mean square deviations (σ). The average quadratic deviation characterizes the variability of the trait. The more the symptom varies, i.e., the greater the difference between the minimum and the maximum values of the attribute, the higher the sigma is and in estimating physical development, the actual deviation value is measured exactly by the sigma value (σ).

Table 3

Age grouping of children and adolescents from 3 to 18 years

3 years	from 2 years 10 months 16 days	to 3 years 2 months 29 days
3 years 6 months	from 3 years 3 months	to 3 years 8 months 29 days
4 years	from 3 years 9 months	to 4 years 2 months 29 days
4 years 6 months	from 4 years 3 months	to 4 years 8 months 29 days
5 years	from 4 years 9 months	to 5 years 2 months 29 days
5 years 6 months	from 5 years 3 months	to 5 years 8 months 29 days
6 years	from 5 years 9 months	to 6 years 2 months 29 days
6 years 6 months	from 6 years 3 months	to 6 years 8 months 29 days
7 years	from 6 years 9 months	to 7 years 5 months 29 days
8 years	from 7 years 6 months	to 8 years 5 months 29 days
9 years	from 8 years 6 months	to 9 years 5 months 29 days
10 years	from 9 years 6 months	to 10 years 5 months 29 days
11 years	from 10 years 6 months	to 11 years 5 months 29 days
12 years	from 11 years 6 months	to 12 years 5 months 29 days
13 years	from 12 years 6 months	to 13 years 5 months 29 days
14 years	from 13 years 6 months	to 14 years 5 months 29 days
15 years	from 14 years 6 months	to 15 years 5 months 29 days
16 years	from 15 years 6 months	to 16 years 5 months 29 days
17 years	from 16 years 6 months	to 17 years 5 months 29 days
18 years	from 17 years 6 months	to 18 years 5 months 29 days

When evaluating physical development by this method, the standard value (M) is subtracted from the actual value of the characteristic. Then, by dividing the obtained actual deviation by the value of the standard deviation (σ), determine by how much sigma the actual child's indices deviate from the average indices for the same age and sex to a greater or lesser extent. The obtained value of deviations is marked on the graph in the form

of a curve (for three points – for mass, height and the circumference of the chest), which is called the physical development profile.

Degree of a trait development is judged by the magnitude of the deviation of the individual value from the standard average value. If the actual value falls within $\pm 1\sigma$ range, then it is characterized as an average value of this indicator. Whenever the actual value of the indicator falls in the interval from $M-1\sigma$ to $M-2\sigma$, it is concluded to be below the average; if from $M+1\sigma$ to $M+2\sigma$ then – above the average, accordingly. The conclusion of being a markedly low or a markedly high level is made for the values, which are correspondingly less than $M-2\sigma$ or higher than $M+2\sigma$.

The decisive factor for determining the degree of physical development is height. To judge the harmony of development (compliance of other indicators with the height), the distance of these three points from each other horizontally (in sigmas) is estimated. If the extreme points are not more than 1σ apart, the development is considered harmonic; whenever more than 1σ , but less than 2σ apart, it is disharmonious, if more than 2σ it is markedly disharmonious.

The disadvantage of this method is the lack of an accurate estimate of the degree of the actual correlation between height and other body parameters, as in assessing physical development, each of the characteristics is evaluated separately from each other (this also holds true with respect to the set of standards – arithmetic mean – for body mass, body length and chest circumference).

Physical development assessment by regression scales. The method of estimating physical development by regression scales allows to assess the harmony of a child's development (viz. the correspondence between the body mass and the body length, and the chest circumference and the body length) in a more accurate way in connection with the fact that at the compilation of evaluation tables and statistical processing of the attributes, existing correlation between anthropometric characteristics is taken into account. The method is the most adequate for assessing physical development in surveys; therefore, in accordance with the current regulatory documents it is recommended that the regression method be used to assess physical development of children and adolescents.

The basis for the evaluation table (regression scale) is the body length, represented in all possible variants (from the minimum to the maximum value with an interval of 1 cm) divided into five groups: low, below aver-

age, medium, above average and high. For each instance of the body length, mean values (M) and partial sigma ($\pm\sigma$) of the body weight and chest circumference were calculated, accordingly (Tab. 4).

Carrying out an individual assessment of physical development according to regression scales, first of all according to the table, determine to which of the five groups the child's body length value belongs. Then along the horizontal line relevant to this height value, the body mass and the circumference of the chest corresponding to the given height are found. With the corresponding values found, the actual body mass and the chest circumference values of the child are compared. To do this, calculate the difference between these values and the actual data of the child. The degree of lagging or exceeding the actual values of the mass and the circumference of the chest from the standard (tabular) is expressed in the amount of regression sigma (σ_R), for which the difference is divided by the corresponding σ_R (it is given at the bottom of the table).

The level of the development of the sign is estimated depending on the degree of deviation of the actual value from the standard (average):

- 1) Low level is determined if the characteristic value is less than $M-2\sigma_R$;
- 2) Below the average level – if the value of the characteristic falls within the interval from $M-1\sigma_R$ to $M-2\sigma_R$;
- 3) Average level is from $M-1\sigma_R$ to $M+1\sigma_R$;
- 4) Above the average level – the value of the characteristic from $M+1\sigma_R$ to $M+2\sigma_R$;
- 5) High level – if the characteristic value is more than $M+2\sigma_R$. Such values are seldom observed.

If the parameter (body weight or chest circumference) is higher or below average, then the child's development should be considered disharmonious. If the sign is low or high, then the development of the child is considered highly disharmonious. The exception is when the mass or circumference of the breast exceeds the average values due to the development of the musculature – then the development of the child can be considered harmonious.

In practice, due to close correlation between weight and chest circumference, it is possible to estimate only two parameters: length and body weight. This approach is widely used in surveys and provides no or little loss of significant information.

Table 4

Regression scale for 10 years old boys

Limits of sig- mal deviations	Height, cm	Body Mass, kg			Chest circumference, cm		
		M-1 σ	M	M+1 σ	M-1 σ	M	M+1 σ
Low (from M- 2 σ and lower)	119	21.1	23.8	26.5	59.8	62.7	65.7
	120	21.5	24.2	26.9	60.0	63.0	65.9
	121	22.0	24.7	27.3	60.2	63.2	66.1
	122	22.4	25.1	27.8	60.5	63.4	66.4
	123	22.8	25.5	28.2	60.7	63.6	66.6
	124	23.3	25.9	28.6	60.9	63.8	66.8
Below the av- erage (from M-1 σ to M- 2 σ)	125	23.7	26.4	29.1	61.1	64.1	67.0
	126	24.1	26.8	29.5	61.3	64.3	67.2
	127	24.5	27.2	29.9	61.6	64.5	67.5
	128	25.0	27.7	30.3	61.8	64.7	67.7
	129	25.4	28.1	30.8	62.0	65.0	67.9
	130	25.8	28.5	31.2	62.2	65.2	68.1
Average (from M-1 σ to M+1 σ)	131	26.3	28.9	31.6	62.5	65.4	68.4
	132	26.7	29.4	32.1	62.7	65.6	68.6
	133	27.1	29.8	32.5	62.9	65.9	68.8
	134	27.5	30.2	32.9	63.1	66.1	69.0
	135	28.0	30.7	33.3	63.4	66.3	69.2
	136	28.4	31.1	33.8	63.6	66.5	69.5
	137	28.8	31.5	34.2	63.8	66.7	69.7
	138	29.3	31.9	34.6	64.0	67.0	69.9
	139	29.7	32.4	35.1	64.2	67.2	70.1
	140	30.1	32.8	35.5	64.5	67.4	70.4
	141	30.6	33.2	35.9	64.7	67.6	70.6
	142	31.0	33.7	36.3	64.9	67.9	70.8
	143	31.4	34.1	36.8	65.1	68.1	71.0
	Above the av- erage (from M+1 σ to M+2 σ)	144	31.8	34.5	37.2	65.4	68.3
145		32.3	35.0	37.6	65.6	68.5	71.5
146		32.7	35.4	38.1	65.8	68.8	71.7
147		33.1	35.8	38.5	66.0	69.0	71.9
148		33.6	36.2	38.9	66.2	69.2	72.1
149		34.0	36.7	39.4	66.5	69.4	72.4
High (from M+2 σ and higher)	150	34.4	37.1	39.8	66.7	69.6	72.6
	151	34.8	37.5	40.2	66.9	69.9	72.8
	152	35.3	38.0	40.6	67.1	70.1	73.0
	153	35.7	38.4	41.1	67.4	70.3	73.3
	154	36.1	38.8	41.5	67.6	70.5	73.5
	155	36.6	39.2	41.9	67.8	70.8	73.7
M	136.59		31.35		66.65		
$\pm\sigma$	5.64		3.61		3.20		
$\pm\sigma R$			2.67		2.94		
Ry/x			0.43		0.22		

Options for assessing physical development are given in accordance with current recommendations:

1. *Normal physical development.* Such conclusion is given to children and adolescents with a height below the average, average or above average (children of 7 years and older) and the average body weight (in children older than 3 years also if the body weight is above average).

2. *Deficiency of weight* – at body weight low or below average.

3. *Excessive body weight* – with a body weight high (and in children under 3 years and above the average).

4. *Low height* – with the height less than $M-2\sigma$.

Variants 2, 3 can be combined with low height.

Children with low height and overweight are referred for consultation to the endocrinologist, since in the first case there may be a general delay in physical development, in the second – obesity and other somatic diseases. In children with body weight deficiency, the pediatrician determines the causes of the deficit.

Centile method of physical development assessment. Centile method for anthropometric data estimating is currently used because of availability of convenient tables. The centile tables are constructed as follows. After the indicators of physical development are studied in a large group of healthy children of different age and sex, the parameter values obtained are ranged on the scale from minimal to maximal. Each such set of values is divided into 100 equal parts and then percentile boundaries are found. Usually not all 100, but only 7 fixed centiles (percentages) are given – 3rd, 10th, 25th, 50th, 75th, 90th and 97th. Centile is a part of the variation scale, reflecting the frequency of occurrence of the trait. Between the fixed centiles there are 8 intervals so called the centile intervals (Tab. 5).

Thus, the centile 3 cuts off 3% of the lowest values of the trait out of the whole possible range of values in the set. Similarly, the centile 97 (or 97% percentile) cuts off 3% of the highest values of the trait. Likewise the other centiles do. Knowing that the child's height fits between the values of C and D, we find that it falls into the fourth centile interval.

In the centile method, the value of the observed trait is considered average or typical if falls in the range of 25–75 centiles, that is, values corresponding to the intervals 4 and 5. Occurrence of individual values in the intervals 1–3 indicates a decrease, and in the intervals of 6–8 then increase in comparison with the average value.

Table 5

Structure of centile tables

Centiles (%)		3		10		25		50		75		90		97
Centile intervals	1		2		3		4		5		6		7	8
Significator value (height or weight)		A		B		C		D		E		F		G

In practice, the following options are possible in physical development assessment:

Parameter	Centile interval	Parameter	Centile interval
Low body mass:	1	Low body length:	1
Reduced body mass:	2, 3	Reduced body length:	2, 3
Normal body mass:	4, 5, 6	Normal body length:	4, 5, 6, 7
Increased body mass:	7	High body length:	8
High body mass:	8		

The centile method, as well as others, can be used to evaluate some quantitatively expressed anthropometric parameters – height, mass, circumference, muscle strength.

The disadvantage of this method is the lack of accounting for the correlation between height, body weight and the circumference of the chest. Each of these indicators is evaluated separately, out of communication with others, since only one-dimensional centile scales are constructed for each indicator without taking into account their interrelation.

When evaluating the harmony of the physical development, specifically when considering the body mass with respect to the length of the body, in accordance with the centile method development would be harmonious if the values of the features under consideration turn out to be in one or the adjacent centile intervals; disharmonious if the values are apart beyond the boundaries of the adjacent interval; and is sharply disharmonious if the difference in the estimate constitutes two or more intervals.

Table 6 presents options for assessing physical development by this method. In the complex assessment of physical development, it is necessary to take into account the level of biological development, degree of harmony in physical development, and degree to which functional indicators correspond to the age.

Table 6

Options for assessing physical development by the centile method

Weight interval	Height interval			
	1	2, 3	4, 5, 6, 7	8
1	Low height Low weight	Reduced height Low weight	Average height Low weight	High height Low weight
2, 3	Low height Reduced weight	Reduced height Reduced weight	Average height Reduced weight	High height Reduced weight
4, 5, 6	Low height Average weight	Reduced height Average weight	Average height Average weight	High height Average weight
7	Low height Increased weight	Reduced height Increased weight	Average height Increased weight	High height Increased weight
8	Low height High weight	Reduced height High weight	Average height High weight	High height High weight

In determining the biological age, ossification of individual parts of the skeleton, eruption and replacement of teeth, development of secondary sexual characteristics, etc., are carried out. At different ages, specific set of indices is used most often in children and adolescents (Tab. 7).

So, in the toddler age and pre-school children, the main indicators are body length and its annual increments, in addition to them, data on the development of motor skills and speech can be used. In pre-school, junior and secondary school years (5–12 years), the leading indicators of biologi-

cal development are length of the body and number of permanent teeth. In secondary and senior school age, expression of secondary sexual characteristics and the annual increase in body height are of particular importance; the functional indicators, tooth development and body length are additional.

Using tables of regional averages (Tab. 7), the child's data are compared with the relevant age-specific average values and then we determine whether its biological age corresponds to the passport age, ahead of or behind it. In case of lagging behind or ahead of most indicators by 1 year or more, the lag or acceleration of the age development is noted.

Degree of harmony of physical development is estimated by regression method. The most commonly used functional indicators are muscle strength and vital capacity of the lungs.

Recommended formulation of conclusion on integrated assessment of physical development:

1. *Biological age* corresponds (behind, overdrives) the passport age.
2. *Physical development* is harmonious, disharmonious (normal, lack of mass, excess of mass), sharply disharmonious (lack of mass, excess of mass, low height).
3. *Functional indicators* correspond (or lag behind, or overdrive) the age standards.

PRACTICAL PART

Using tables 7–10, evaluate the physical development of the child specified below:

1. By the method of sigma deviations with construction of the physical development profile.
2. By the centile method.
3. Do comprehensive assessment of physical development by regression method with the indication of biological age omitting the functional indicators.

The child: Katya N. Date of birth: 06.05.2002. Date of the survey: 09.09.2014; the height is 150.0 cm; the body weight – 52.0 kg; the chest circumference – 80.0 cm. The annual height gain is 3 cm; the number of permanent teeth is 28. Secondary characteristics of sexual development: Ma³Ax³P³.

Table 7

Age-specific indicators of biological development of children and adolescents

Age, years	Body length, cm (M±m)	Annual body length increment, cm	Count of permanent teeth (M-σ-M+σ)	Expression of secondary sexual characteristics
Boys				
5	109.8±5.2	5–8	0–1	-
6	114.6±5.6	4–6	1–5	-
7	123.8±3.8	4–6	5–10	-
8	127.1±3.9	4–6	8–14	-
9	133.1±5.9	4–6	12–17	-
10	136.6±5.6	4–6	14–21	Ax ⁰ P ⁰
11	141.4±4.9	4–6	16–24	Ax ⁰ P ⁰
12	146.1±5.5	4–6	21–27	Ax ⁰ P ^{0,1}
13	151.8±6.4	7–10	28	Ax ⁰ P ^{0,1}
14	157.2±7.5	7–10	28	Ax ^{1,2} P ^{1,2}
15	164.7±6.8	4–7	28	Ax ^{2,3} P ^{2,3}
16	170.2±6.0	3–4	28	Ax ³ P ^{3,4}
17	170.9±5.5	1–2	28	Ax ³ P ⁴
Girls				
5	110.9±3.8	5–8	0–1	-
6	115.6±5.1	4–6	1–6	-
7	124.4±3.6	4–5	6–11	-
8	127.1±4.6	4–5	11–14	-
9	132.2±4.7	4–5	12–18	Ma ⁰ Ax ⁰ P ⁰
10	136.5±4.9	4–5	15–22	Ma ^{0,1} Ax ⁰ P ⁰
11	141.2±5.5	6–8	18–25	Ma ^{0,1} Ax ^{0,1} P ^{0,1}
12	149.8±5.7	6–8	18–25	Ma ^{1,2} Ax ^{1,2} P ^{1,2}
13	154.2±5.4	4–6	28	Ma ^{2,3} Ax ^{2,3} P ^{2,3} menarche
14	157.0±4.6	2–4	28	Ma ^{2,3} Ax ^{2,3} P ³ menses
15	160.1±4.4	1–2	28	Ma ³ Ax ³ P ³ or anyone is of 2nd degree; menses
16	160.4±4.9	1–2	28	Ma ³ Ax ³ P ³ menses
17	160.7±5.0	0–1	28	Ma ⁴ Ax ³ P ³ menses

Table 8

Regression scales for 12 years old girls

Limits of signal intervals	Height, cm	Body weight, kg			Chest circumference, cm		
		M-1 σ	M	M+1 σ	M-1 σ	M	M+1 σ
Low (from M-2 σ and below)	132	27.4	31.1	34.8	61.7	65.6	69.4
	133	27.9	31.6	35.3	62.0	65.9	69.8
	134	28.4	32.1	35.8	62.4	66.3	70.2
	135	28.9	32.6	36.3	62.8	66.6	70.5
	136	29.4	33.1	36.8	63.1	67.0	70.9
	137	30.0	33.6	37.3	63.5	67.4	71.2
Below the average (from M-1 σ to M-2 σ)	138	30.4	34.1	37.8	63.8	67.7	71.6
	139	30.9	34.6	38.3	64.2	68.1	72.0
	140	31.4	35.1	38.8	64.6	68.4	72.3
	141	31.9	35.6	39.3	64.9	68.8	72.7
	142	32.4	36.1	39.8	65.3	69.2	73.1
	143	32.9	36.6	40.3	65.7	69.5	73.4
Average (from M-1 σ to M+1 σ)	144	33.4	37.1	40.8	66.0	70.0	73.8
	145	33.9	37.6	41.3	66.4	70.3	74.1
	146	34.4	38.1	41.8	66.7	70.6	74.5
	147	34.9	38.6	42.3	67.1	71.0	74.9
	148	35.4	39.1	42.8	67.5	71.3	75.2
	149	35.9	39.6	43.3	67.8	71.7	75.6
	150	36.5	40.1	43.8	68.2	72.1	75.9
	151	37.0	40.7	44.3	68.5	72.4	76.3
	152	37.5	41.2	44.9	68.9	72.8	76.7
	153	38.0	41.7	45.4	69.3	73.1	77.0
	154	38.5	42.2	45.9	69.6	73.5	77.4
	155	39.0	42.7	46.4	70.0	73.9	77.7
	156	39.5	43.2	47.4	70.3	74.2	78.1
Above the average (from M+1 σ to M+2 σ)	157	40.0	43.7	47.4	70.7	74.6	78.5
	158	40.5	44.2	47.9	71.1	74.9	78.8
	159	41.0	44.7	48.4	71.4	75.3	79.2
	160	41.5	45.2	48.9	71.8	75.7	79.5
	161	42.0	45.7	49.4	72.1	76.0	79.9
	162	42.5	46.2	49.9	72.5	76.4	80.3
High (from M+2 σ and above)	163	43.0	46.7	50.4	72.9	76.7	80.6
	164	43.5	47.2	50.9	73.2	77.1	81.0
	165	44.0	47.7	51.4	73.6	77.5	81.4
	166	44.5	48.2	51.9	74.0	77.8	81.7
	167	45.0	48.7	52.4	74.3	78.2	82.1
	168	45.5	49.2	52.9	74.7	78.6	82.4
M	149,83		40.16			72.07	
$\pm\sigma$	5,74		4.73			4.40	
$\pm\sigma R$			3.68			3.90	
Ry/x			0.52			0.34	

Table 9

Centile ranks of the height for girls (cm)

Age	Centiles												
	3		10		25		75		90		97		
	Centile intervals												
	1	2	3	4-5	6	7	8						
0 mon.		47		48		49.2		52.1		53.3		54.5	
1 mon.		49.7		50.7		52.4		55.3		56.9		57.7	
2 mon.		52.2		53.3		55		58.6		59.9		60.8	
3 mon.		55.1		56.1		57.9		61.5		63		63.9	
4 mon.		57.4		58.6		60.5		64.1		65.6		66.4	
5 mon.		59.9		61		62.8		66.4		67.8		68.8	
6 mon.		62.1		63		64.3		68.2		69.8		70.8	
7 mon.		63.7		64.2		66.4		70		71.6		72.7	
8 mon.		65.2		66.1		67.7		71.6		73.1		75.2	
9 mon.		66.5		67.5		69.3		72.8		74.5		75.8	
10 mon.		67.7		68.8		70.5		74.2		75.9		77.1	
11 mon.		69		70.3		71.7		75.7		77.1		78.3	
12 mon.		70.3		71.4		72.8		76.3		78.3		79.3	
15 mon.		72.2		73.6		75.2		78.8		81.2		82.4	
18 mon.		74		75.8		77.5		82.1		84.4		86	
21 mon.		76		78.2		80		84.6		87.4		88.8	
24 mon.		78.4		80.4		82.6		87.5		90.2		92.2	
27 mon.		80.8		83		85.4		90.1		93		94.7	
30 mon.		83.4		85.6		87.8		92.8		95.6		97.3	
33 mon.		85.9		88.2		90.3		95.5		98.2		100	
36 mon.		88.6		90.8		92.9		98.1		100.8		102.9	
3.5 y.		91		93.4		95.6		101		103.9		105.8	
4 y.		94		96.2		98.4		104.2		106.9		109.1	
4.5 y.		96.9		99.3		101.5		107.1		110.6		114	
5 y.		99.9		102.4		104.9		110.7		114		116.5	
5.5 y.		102.4		104.7		108		115.2		118		120	
6 y.		105.3		108		111		118		120.8		124	
6.5 y.		108		110.5		114		121.7		124.4		127.4	
7 y.		111		113.6		117.1		125		128.1		131.3	
8 y.		116.6		119.4		123		131		134.4		137.6	
9 y.		122		124.4		128.5		136.7		140.6		143.8	
10 y.		127		130		133.8		142.5		146.6		150.1	
11 y.		131		134.2		138.6		148.6		153.9		156.8	
12 y.		135.2		138.4		143		155.1		159.3		163.5	
13 y.		139.5		143.1		148		160.3		164.3		168	
14 y.		144		147.4		152.4		164.2		168		170.5	
15 y.		148.1		151.6		156.3		167		170.3		172.6	
16 y.		151.7		155		158.3		169		172		174.1	
17 y.		154		157		161		170		173		175	

Table 10

Centile ranks of the body mass for girls (kg)

Age	Centiles												
		3		10		25		75		90		97	
	Centile intervals												
	1		2		3		4-5		6		7		8
0 mon.		2.3		2.6		3		3.5		3.8		4	
1 mon.		3		3.3		3.7		4.3		4.6		4.9	
2 mon.		3.7		4		4.4		5		5.3		5.6	
3 mon.		4.4		4.6		5		5.7		6.1		6.5	
4 mon.		5		5.3		5.6		6.5		6.9		7.4	
5 mon.		5.5		5.8		6.2		7.2		7.7		8.2	
6 mon.		6.1		6.3		6.8		7.9		8.5		9	
7 mon.		6.5		6.8		7.3		8.5		9.1		9.7	
8 mon.		7		7.3		7.7		9.1		9.7		10.5	
9 mon.		7.4		7.7		8.2		9.6		10.4		11.2	
10 mon.		7.7		8.1		8.7		10.1		11		11.3	
11 mon.		8.1		8.5		9.1		10.6		11.5		12.2	
12 mon.		8.3		8.8		9.4		11		11.9		12.6	
15 mon.		8.9		9.4		10		11.7		12.7		13.3	
18 mon.		9.4		9.9		10.6		12.5		13.4		13.9	
21 mon.		9.8		10.4		11.1		13.1		13.9		14.6	
24 mon.		10.3		10.9		11.6		13.5		14.5		15.2	
27 mon.		10.8		11.3		12		14		15		15.7	
30 mon.		11.2		11.7		12.5		14.5		15.5		16.3	
33 mon.		11.5		12.1		12.9		14.9		16		16.8	
36 mon.		11.8		12.5		13.3		15.4		16.5		17.3	
3.5 y.		12.4		13.1		14		16.3		17.8		18.6	
4 y.		13.1		13.9		14.8		17.2		19		20	
4.5 y.		13.8		14.9		15.8		18.4		20.4		21.6	
5 y.		14.9		15.8		16.9		19.8		21.9		23.7	
5.5 y.		15.6		16.6		17.8		21.2		23.6		25.8	
6 y.		16.3		17.4		18.8		22.5		25.1		27.9	
6.5 y.		17.1		18.2		19.9		24		26.7		29.8	
7 y.		18		19.3		20.8		25.3		28.4		31.8	
8 y.		20		21.2		23		28.5		32.2		36.4	
9 y.		21.9		23.3		25.4		32		36.4		41	
10 y.		23.9		25.6		28		36		41.1		47	
11 y.		26		28		31.1		40.3		46		53.5	
12 y.		28.4		31.4		35.2		45.4		51.3		58.8	
13 y.		32		35.3		40		51.8		56.8		64.2	
14 y.		36.1		39.9		44		55.9		60.9		70	
15 y.		39.4		43.7		47.6		58		63.9		73.6	
16 y.		42.4		46.8		51		61		66.2		76.1	
17 y.		45.2		48.4		52.4		62		68		79	

QUESTIONS FOR SELF-CONTROL

1. Physical development of children and adolescents as one of the most important indicators of health. Definition of the concept.
2. Basic somathometric indicators, their significance, instruments, conditions, methods of their measurement.
3. Somatoscopic indicators of physical development of children and adolescents; methods of their investigation.
4. Physiometric indicators characterizing physical development of children and adolescents, instruments, methods of their study.
5. The concept of regional standards for physical development; methodology for their obtaining.
6. Methods for assessing the physical development of children and adolescents.
7. The method of sigma deviations with a graphic representation of the physical development profile: the essence of the method, the disadvantages.
8. The method of regression scales in assessing physical development: the essence of the method, advantages.
9. The centile method of physical development assessment, its essence, disadvantages, advantages.
10. Indicators characterizing biological age.
11. Comprehensive assessment of the physical development of children and adolescents.

TEST TASKS

Choose one correct answer

1. INFORMATIVE INDICATOR OF THE BIOLOGICAL AGE OF A PRESCHOOL AGE CHILD IS
 - 1) annual increase in body length
 - 2) head circumference
 - 3) body weight
2. METHOD, USED FOR ASSESSMENT OF HARMONITY OF PHYSICAL DEVELOPMENT OF CHILDREN AND ADOLESCENTS ACCOUNTING FOR REGIONAL PARTICULARITIES, IS

- 1) method of sigma deviations
- 2) centile method
- 3) regression method

3. THE POSTURE IS

- 1) position of a person standing free
- 2) habitual sitting position
- 3) position of the body while standing straining
- 4) correct position of the body in space

4. CHANGE OF INFANT TO PERMANENT TEETH BEGINS AT THE AGE OF A CHILD

- 1) 4–5 years
- 2) 5–6 years
- 3) 6–7 years

5. DEVELOPMENT OF SECONDARY SEXUAL CHARACTERISTICS IN GIRLS IS ASSESSED STARTING FROM THE AGE OF

- 1) 17 years
- 2) 28 years
- 3) 39 years
- 4) 10 years

6. SECONDARY SEXUAL CHARACTERISTICS ARE CORRESPONDENT TO THE FOLLOWING CATEGORY OF PHYSICAL DEVELOPMENT INDICATORS

- 1) somatometric indicators
- 2) somatoscopic indices
- 3) physiometric indicators

7. BIOLOGICAL AGE IS

- 1) period lived by the child from birth to the moment of the examination
- 2) set of morphological and functional properties of the organism, depending on the individual rate of growth and development
- 3) degree of development of secondary sexual characteristics

8. DEGREE OF SKELET OSSIFICATION IN CHILDREN AND ADOLESCENTS IS EVALUATED

- 1) during planned medical examinations
- 2) upon admission of children to school
- 3) with pronounced violations of physical development

9. ANTHROPOMETRIC INDICATOR, MOSTLY AFFECTED BY ENVIRONMENT FACTORS, IS

- 1) body weight
- 2) body length
- 3) chest circumference

10. HEALTH GROUPS OF CHILDREN AND ADOLESCENTS ARE DEFINED BASED ON CRITERIA, DEVELOPED BY

- 1) Yu.E. Veltishchev
- 2) G.N. Serdyukovskaya
- 3) V.N. Kardashenko
- 4) S.M. Grombach

SITUATIONAL PROBLEMS

Problem 1. Boy M. Date of birth: 05.04.2005. Date of the survey: 06.10.2015. Height – 138.4 cm. Body weight – 36.4 kg. The circumference of the chest is 68.8 cm.

Assess the level and harmony of the physical development.

Problem 2. Girl N., 13 years old, her height is 144 cm, for a year the height has increased by 5 cm. The sexual formula $Ah_0P_1Ma_1$, menses is absent. The number of permanent teeth is 24.

Compare the data of the child with the age-specific norms and determine the correspondence of the biological age to the passport one.

Problem 3. The age of the child on the day of survey is 4 years 9 months 12 days. Determine the age group of the child.

2. SANITARY-HYGIENIC EXAMINATION OF THE PROJECTS OF PRESCHOOL EDUCATIONAL ORGANIZATIONS

Purpose of the lesson is to familiarize students with the hygienic principles of placement, planning, improvement of preschool educational organizations (PSEO).

Hygienic principles of accommodation and types of preschool educational organizations. For preservation and strengthening of the health of younger generation, hygienically valuable environment is of great importance, and it is determined by improvement and sanitary conditions of preschool educational organizations.

Planning and developing kindergarten housings should provide most favorable conditions for the life and health of children. The choice of the land plot, design and construction of preschool educational organizations is made only if permitted by Rospotrebnadzor. The following hygienic principles must be taken into account when placing and constructing a PSEO. Observance of them allows preserving the health of a child and promoting harmonious physical and neuropsychic development.

The principle of group isolation inside the building and on the playground outside must be observed by the reason of high susceptibility of children to infectious diseases and lack of sufficient immune response to them. However, children who have already recovered from certain infectious diseases acquired immunity and are therefore resistant to them. The principle of isolation of children by age groups is also necessary in order to create the proper regime of the day, conditions of upbringing for children of different ages in accordance with their anatomical and physiological characteristics. To ensure this principle, each group of children must have a complete set of all necessary rooms in the building and separate playgrounds on the land plot of the PSEO.

The principle of providing conditions for motor activity. As you know, children are characterized by a high need for movement, hence relevant conditions must be created in the form of a sufficient set of rooms, sufficient area of the group rooms, of the gym, and of the outdoor playgrounds.

The principle of creating a favorable microclimate must be observed in connection with the relatively intensive metabolism of children and imperfection of the thermoregulation mechanisms at the same time. Com-

pliance with this principle helps prevent overcooling and overheating of children and, as a result, the incidence of a cold.

The principle of providing sufficient natural and artificial lighting is a measure of prevention of refractive disorders, as preschool-age children have visual analyzer that is not completely formed, while the visual work performed is quite intense. In addition, the radiant energy of the sun contributes to the full growth and development of a child's body.

The principle of creating conditions for rational nutrition is in connection with the age requirements of a child in food substances and energy. To ensure this principle, PSEO should have nutrition unit functioning in compliance with all sanitary and epidemiological norms and rules, the staff of professional cooks and health workers. Holding with this principle contributes to proper growth and development of a child, formation of healthy eating habits, and is the most important measure for prevention of nutritional diseases.

The main types of preschool educational institutions include toddler age facilities, kindergartens and their combination. PSEO is organized for children aged from 2 months to 7 years; groups are completed according to the age principle (Tab. 11).

Table 11

Age group structure of preschool children's organizations

Group	Age, years
TODDLER	from 2 months to 3 years
Younger (first toddler group)	from 2 months to 1 year
Middle (second toddler group)	from 1 to 2 years
Senior (first junior group)	from 2 to 3 years
PRESCHOOL	from 3 to 6 years
Younger (second junior group)	from 3 to 4 years
Middle	from 4 to 5 years
Senior	from 5 to 6 years
PREPARATORY TO SCHOOL	from 6 to 7 years

The number of children in groups of a general purpose PSEO is determined on the basis of the floor area norms per 1 child. The number and ratio of the age groups in PSEO of a compensating type that performs a qualified correction of deficiencies in physical and/or mental development is determined taking into account the characteristics of psychophysical development and abilities of the children. The recommended number of children in the compensatory groups for children under 3 years should not exceed 6 children; the amount of children over the age of 3 years is 10.

It is allowed to unite groups of combined orientation with the joint stay of healthy children and children with disabilities, carried out in accordance with the peculiarities of psychophysical development and the abilities of children.

Depending on the length of stay of children, PSEO can function in the mode of short stay (up to 5 hours per day), partial day (8–10 hours), full-time (10.5–12 hours), an extended day (13–14-hour stay) and a 24-hour stay of children.

Hygienic requirements for the placement of preschool educational organizations. Preschool educational organizations are placed near the residential area of the contingent being served and at a significant distance from roads and railways, enterprises that pollute the air with harmful impurities or produce significant noise, away from garages. The width of the sanitary protection zone for PSEO, depending on the hazard class of the industrial enterprise, is as follows:

- not less than 1000 m from the enterprises of the 1st class;
- not less than 500 m from the enterprises of the 2nd class;
- not less than 300 m from the enterprises of the 3rd class;
- not less than 100 m from the enterprises of the 4th class;
- not less than 50 m from the enterprises of the 5th class.

In the city, the optimal variant of the PSEO placement is such, when residential buildings are located along the perimeter of the site, and transport routes are removed by more than 100 m. The service radius of the PSEO should provide pedestrian accessibility and is 0.3 km in cities, rural settlements and urban settlements type with one- and two-storey buildings – no more than 0.5 km.

Hygienic requirements for the land plot of preschool educational organizations. The land plot is intended for conducting educational work, labor and physical education, active recreation, and training.

The area of the land for newly constructed PSEO as a separate building is assumed to be 40 m² per 1 seat; for capacity of up to 100 seats – 35 m² per 1 seat; for the built-in building PSEO with a capacity of more than 100 seats – not less than 29 m² per 1 seat. In the northern regions, the area of the land plot may be reduced, but not more than 30%, after consultation with the territorial Center of the State Sanitary and Epidemiological Supervision.

The territory of preschool educational organization along the perimeter should be protected by a fence and a strip of green plantations if the PSEO has its own territory.

The territory of a preschool educational organization must have external electric lighting. The level of artificial illumination during stay of children on the territory must be at least 10 lux at the ground level at night.

Levels of noise and air pollution in the territory of preschool educational organizations should not exceed the permissible levels established for the territory of residential buildings.

The following functional areas are allocated on the land plot:

- Building zone;
- Playground territory;
- Economic zone;

The building zone includes the main building of the PSEO. With a high density of multi-storey buildings in cities, as well as in the construction of a public health center in urban buildings, an extension of a building with a capacity of up to 140 places to residential buildings is allowed, provided there is a separate fenced area with independent entrance and entry. The area of site development should not exceed 10–12%.

The playground zone includes group platforms and a sports ground. Group sites (individual for each group) contain area at least 7 m² per 1 child toddler and at least 9.0 m² per 1 child of a preschool age.

Under conditions of dense urban development, taking into account organization of walks, the use of combined group sites is allowed.

For preschool educational organizations providing services for child care it is allowed to use the equipped places for children's walks and physical education, located on the territory of public gardens, parks and other areas that are suitable for children's walks and physical education. The group ground sites are connected by a ring track 1.5 m wide for bicycles, pedal cars, skis, sledges, learning of traffic rules. Covering sites include

grass compacted soil, dust-free or made of materials that do not have harmful effects on humans; in areas of permafrost the site coverage should be planked.

Group sites for toddlers are located in the immediate vicinity of the exits from the premises of these groups.

To protect children from direct sunlight and rainfall on the territory of each group platform, establish a shady canopy area of at least 1 m² per child. For groups of less than 15 people, the area of the shady canopy must be at least 20 m².

Shadow canopies should have a wooden floor, installed at a distance of at least 15 cm from the ground. Shadow canopies are shielded from three sides; the height of the enclosure should be at least 1.5 m.

It is allowed to install a collection of canopies and pavilions on the promenade for use in the hot season.

Under conditions of the Far North, instead of shady canopies, heated walking verandas are equipped with a minimum of 2 m² per child with ventilation for the verandas.

Canopies or walking terraces for children under 2 years of age can be attached to the building of a preschool educational organization and used as verandas for organizing walks or sleeping. Shadow awnings, attached to buildings, should not obscure the spaces of group cells and reduce the natural illumination.

To store toys used in the territory of preschool educational organizations, wheelchairs, sledges, bicycles, skis, a special place is allocated, protected by a canopy from precipitation.

Playgrounds and sports grounds for children are equipped with a view of their height and age characteristics. The play equipment must correspond to the age of the children and be made of materials that do not have a harmful effect on a person.

Playgrounds for preschool groups are equipped for high movement activity of children with horizontal bars, gymnastic walls, slides, steps, swings, labyrinths.

Annually, in the spring period, a complete sand change is carried out on the playgrounds. Newly imported sand must comply with hygienic standards for parasitological, microbiological, sanitary and chemical, radiological indicators. Sandboxes in the absence of children must be closed to avoid sand contamination (lids, polymer films or other protective devices).

When there are pathogens of parasitic and infectious diseases, an extraordinary change of sand occurs.

The general physical training area consists of:

- Zones with equipment for outdoor games;
- Zones with gymnastic and other sports equipment;
- Treadmill;
- Pits for jumping;
- Obstacle strips;

- For the III climatic region it is allowed to arrange open swimming pools for children near the athletic area.

In a PSEO with a capacity of up to 150 seats equip one sports ground with size of at least 250 m², with capacity of more than 150 seats – two areas 150 and 250 m². Covering the zone with equipment for outdoor games is herbal; the rest is hard ground or wooden.

The economic zone should be located at the entrance to the production premises of the canteen and have an independent entrance. Under conditions of existing dense urban development, lack of independent entry from the street is permissible.

In case of impossibility to equip independent entrance to the territory of the economic zone, the motor transport access to the economic site is carried out during the absence of children at the ground of the PSEO.

On the territory of economic zone there should be places for drying bedding and carpet cleaning; it is possible to place a vegetable store.

In the economic zone there is a garbage collection area at a distance of at least 15 m from the building. On a paved area, containers with lids are installed. The area should be larger than the area of the base of the containers. It is allowed to use other special closed structures for collecting garbage and food waste, including placing them on adjacent container sites of residential development.

The territory is cleaned daily in the morning 1–2 hours before the arrival of children or in the evening after the departure of children. In dry and hot weather, it is recommended to irrigate the area at least 2 times a day. In winter, snow-removal (approaches to the building, pathways, paths, recreational areas and games) is carried out as required, the use of chemical reagents is not allowed.

Entrances to the territory of a preschool educational organization, driveways, paths to economic buildings, to a container site for garbage collection are covered with asphalt, concrete or another hard surface.

The area of landscaping of the territory of PSEO should be at least 50% of the area free from construction. For the regions of the Far North, as well as in cities under conditions of dense urban development, the reduction of gardening to 20% of the area free from building is allowed.

Green plantations separate the group zones from each other and from the economic zone, protect them from dust, noise, wind, etc. A green protective strip of trees and bushes with a width of at least 1.5 m is arranged along the perimeter of the site, at least 6 m from the street side. Trees are planted at a distance of at least 15 m, shrubs – 5 m from the building of PSEO. When landscaping the territory, planting of fruit-bearing trees and bushes, poisonous and thorny plants is forbidden.

Hygienic requirements for the building of a preschool educational organization. The buildings of preschool educational organizations can be separately standing compact, block or pavilion structure, i.e., consist of several pavilion buildings, separately standing or connected to each other by heated transitions. In addition, preschool educational institutions can be built-in or attached to residential buildings, administrative and public buildings (except for the administrative buildings of industrial enterprises).

In the presence of a separate fenced area, an independent entrance for children and for motor vehicles is equipped. The capacity of preschool educational organizations is determined by the design assignment. The number of groups in the operating toddler facilities and their capacity are shown in the Table 12.

The group capacity of newly constructed PSEO should not exceed 350 seats; capacity of the PSEO attached to the ends of residential buildings and built into residential buildings – no more than 150 seats. The capacity of the PSEO for rural and urban settlements is recommended not more than 140 places.

The building of preschool educational organization must have a number of floors not higher than three. On the third floors of PSEO it is recommended to place groups for children of senior preschool age, as well as additional rooms for working with children. Rooms for children under 3 years old are located on the 1st floor. The building layout includes 4 groups of rooms of the following functional purpose:

Number of groups in kindergartens and the correspondent capacity in existing organizations

Kindergarten capacity (place count)	Number of younger groups; number of children in one group	Number of senior groups; number of children in one group
25	1 × 10 *	1 × 15
50	1 × (10–15)	1 × 25
90	2 × 20	2 × 25
140	2 × 20	4 × 25
280	4 × 20	8 × 25
320	6 × 20	8 × 25
560	8 × 20	16 × 25
640	12 × 20	16 × 25

Note* – The first number is the quantity of groups; the second is the quantity of children in the group.

- Kindergarten rooms – isolated indoor areas for each children's group);
- Additional rooms for classes with children (music hall, gym, speech therapist's room and others);
- Accompanying premises (medical unit, food block, laundry room);
- Service and domestic facilities for the staff.

The internal layout of the building should provide conditions for adherence to the principle of group isolation, and each room for toddlers must have independent access to the playground. In the building of PSEO, single entry equipment with a common ladder for the groups of toddler children and those of preschool ages is allowed but no more than for 4 groups. Administrative rooms can have an entrance common with one of the preschool age groups. In PSEO for 90 or more seats it is recommended to arrange separate entrances to the kitchen and laundry.

The external entrances of buildings located in I, II and III climatic zones should be with a double tambour not less than 1.6 m as deep. Tambours should be located on the leeward side of the building or in the walls parallel to the direction of winter winds.

A room for toddler age children includes a reception room for the reception of children and storage of outer clothing (18 m²); a dining room (2.5 m² for 1 child); bedroom (1.8 m² for 1 child); toilet room (12 m²); pantry for preparation of ready dishes for distribution and washing of tableware (3 m²). In the waiting room for children less than 1 year there is a place for parents to take off their clothes and mothers to feed their babies . To inspect and swaddle infants and young children, the waiting room is equipped with swaddling tables, chairs, a hand wash basin, a wardrobe for mothers. A place for breast feeding of children is equipped with a table and a chair.

The room for preschool children includes a dressing room (18 m²); room for games, classes and meals (2 m² per 1 child); bedroom (2 m² for 1 child); toilet room (16 m²); pantry (3 m²).

Dressing rooms are equipped with wardrobes for children's outerwear and staff. Cabinets for clothing and footwear are equipped with individual cells for the headgear shelves and hooks for outerwear. Each individual cell is marked.

In the dressing rooms (or in separate rooms) there should be space for drying children's outerwear and shoes.

You can use the room to organize sleep using pull-out beds or folding beds with a hard bed. When using folding beds in each group there should be provided a place for their storage, as well as for the individual storage of bedding and linen.

Bedrooms during the wakefulness of children can be used to organize gaming activities. In this case, the regime of ventilation and wet cleaning should be strictly observed: in the bedroom, a wet cleaning should be carried out at least 30 minutes before the children sleep, with constant airing for 30 minutes.

Toilet rooms are divided into a washroom and a sanitary unit area. In the washroom there are children's washbasins and a shower tray. Toilets are placed in the sanitary unit area.

Toilet in toddler children groups should be provided with personalized pots for each child, who is actually present in the group of PSEO.

In the senior and preparatory groups, separate toilet rooms (lockable booths) are provided for boys and girls.

Toilet bowls are equipped with children's seats or sanitary napkins made of materials that are harmless to the health of children, which can be treated with detergents and disinfectants.

In the toilet facilities (next to the washbasins or opposite to them), hangers for children's towels (separately for the hands and for the feet) are installed according to the payroll structure of the children, the household cupboard and the cabinet for the cleaning inventory.

The height of all rooms is 3 m. When constructing buildings from the panels of apartment houses, a height of 2.7–2.8 m is allowed with a corresponding increase in the area of group rooms by 20%.

Dislocation of rooms can be by the whole-floor, terminal or pavilion type. On the first floor of the building it is recommended to place rooms for toddlers, kitchens, isolators, a medical office, a sick child's room, a manager's office, a laundry room. On the second floor there are rooms for preschool children.

The following premises should be directly connected to each other: in groups of pre-preschool age – a reception room with a playing room, a playing room with a bedroom or a veranda, a toilet and a pantry; in preschool groups – dressing room with a group, group with a toilet, a bedroom, a veranda, a room for storing beds and a pantry.

There should be internal communication between all groups and room for musical and gymnastic classes, a room for sick children, an isolator and service rooms, but without going through the rooms of the groups.

Additional rooms for classes with children. For physical education classes, singing, organization of holidays in the premises of kindergartens up to 120 seats, there is a hall for musical and gymnastic classes of 75 m², in a larger PSEO – 2 halls: one room is intended for music classes, the other is for gyms not less than 75 m² each. If there is one room in the preschool educational organization, an equipped physical training ground is recommended for physical exercise in the open air. In the halls there are equipped storerooms for the storage of gym and musical equipment with an area of at least 6 m.

To conduct physical training in the buildings of preschool educational organizations in the I climatic region it is allowed to use heated walking verandas.

In the buildings of PSEO, a swimming pool with a bath 3–4 m in width, 6–7 m in length, and depth of water should be from 0.6 to 0.8 m. The swimming pool includes a hall with a bath, two dressing rooms with showers and a toilet, coach room, nurse's room, a water analysis laboratory, control node. In the construction, installation and operation of a children's pool in the PSEO, sanitary and epidemiological requirements for the

installation of swimming pools, their operation, the quality of the swimming pool water and quality control should be observed.

To train children using computers, you need a special room with a north, north-eastern orientation of the windows.

Medical premises include a medical office (12 m²), a treatment room (8 m²), and a toilet (6 m²). The toilet provides a place for the preparation of disinfection solutions.

The medical unit (medical office) should have a separate entrance from the corridor. To temporarily isolate sick children, a medical or procedural room is allowed. When the preschool educational organization is placed in the built-in buildings attached to the dwelling houses, it is allowed to equip the places for temporary isolation of the ill children, separated by a transformable partition in the office of the head of the PSEO.

In existing preschool educational organizations, medical facilities (medical block) are allowed in accordance with the projects for which they were built. Service premises include the office for the head (9–10 m²), methodologist (12 m²), manager (6 m²), storerooms (4–12 m²), staff dining room (10 m²), staff toilets on each floor of the building (3–6 m²).

The composition and area of nutrition unit depend on the capacity of the PSEO and the specifics of its supply with products – raw materials or semi-finished products. The composition of food units designed for cooking from raw materials includes a hot shop, a dispensing shop, a cold meat shop, a meat processing workshop, a primary vegetable processing workshop, a kitchen washer, a dry food storehouse, a vegetable store, a room with refrigeration equipment for perishable food storage.

The nutrition unit should be located on the 1st floor and have a separate entrance from the street. Do not place kindergarten room, gaming and bedroom windows over it. Storage rooms are not located under the washing, shower rooms and sanitary units.

Interior construction of the kitchen unit provides a sequence of technological processes that exclude counter flows of raw and finished products. For the food unit dealing with semi-finished products, it is necessary to provide a loading, preparation shop, a hot shop, a cold shop, a dispenser, a storage room for bulk products, a room with refrigeration equipment for storage of perishable products, and a washing kitchen utensil.

Children's meals are organized in a kindergarten room. Delivery of food from the kitchen to the group is carried out in specially marked con-

tainers. The labeling should include group membership and the type of dish (first, second, third).

For washing tableware, the pantry is equipped with two-cavity washing tubs with cold and hot water supplying them. It is allowed to install the dishwasher in the pantry.

The washroom consists of washing (12–18 m²), drying and ironing (10–12 m²). The washing and ironing facilities must be adjacent. Entrances (reception windows) for delivering dirty linen and receiving clean linen should be separate. The entrance to the laundry room is not recommended to be arranged in front of the entrance to the premises of the kindergarten rooms. In the buildings of kindergartens there are places for storing carriages and sledges.

Basic hygienic requirements for lighting conditions in preschool educational institutions. The levels of natural and artificial lighting in preschool educational organizations must meet the existing sanitary epidemiological requirements for natural, artificial and combined lighting of residential and public buildings.

Natural lighting depends on the climate, configuration of the building and its location on the site, the size and design of the windows, and their orientation along the sides of the horizon (Tab. 13).

Table 13

Recommended orientation of windows

Rooms	North 60°	60–45°*	South 45°
Group residential area	S	S	S
Sleeping room	E	E	N
Hall for musical and physical training;	S	S	S
Isolator-ward	E	E	E
Medical office, Kitchen rooms	N	N	N

Note* Tomsk is located to the north of 55°N latitude.

To ensure sufficient insolation, the sanitary distance from the PSEO to residential and public buildings when placing them from the side of the group rooms should take at least 2.5 heights of the opposing highest building of the unfinished type, between the PSEO and the 9-floor tower-type house – 36 m, 16-floor – 60 m, accordingly.

All the main premises of the building should be provided with natural lighting. Lighting with a second light of the pantry, bed-room, store for food, laundry room, economic and restroom for the staff is allowed. When considering the project, the light coefficient, the depth factor, and the orientation of the main rooms windows are determined and evaluated.

The luminous coefficient (the ratio of the area of the glazed surface of the windows to the floor area) in the group rooms, bedrooms, and isolator should be 1:4; in reception rooms, dressing rooms, medical rooms, kitchen and toilet – 1:5 and 1:6; in the auxiliary rooms – 1:8.

The penetration coefficient is the ratio of the depth of the room (distance from the window to the opposite side) to the distance measured from the top edge of the window to the floor. Good lighting is provided by the coefficient value of no more than 2.5.

The windows of the main premises should be oriented mainly to the south. Optimum illumination is provided throughout the year, maximum sunlight penetration into the room in winter and moderate solar radiation in the spring months. Halls for music and gymnastics classes should ideally be oriented to the south, but any orientation is acceptable. Favorable are eastern, southeastern and southwestern orientation. They are not allowed to be oriented to the north and northwest, and in regions to the south of 45°N latitude – to the west and southwest because of overheating of the premises. The best configuration of the building is a straight hull, elongated equatorially.

Height of window sills in rooms and bedrooms is recommended to be 50–60 cm. The depth of penetration of light rays into the room depends on the height of the upper edge of the window. Therefore, the window openings should be maximally raised, so that the distance from the ceiling to the top of the window was not more than 1530 cm. In one-sided lighting, the depth of room spaces should not exceed 6 m. For larger depths of rooms, a two-sided parallel or angular arrangement of the windows is required to ensure through ventilation. Window openings in the bedrooms should be located on at least two walls.

In the toddler children kindergartens, designed for I climatic region, glazed walking terraces are provided.

Basic hygienic requirements for ventilation and indoor microclimate of preschool educational organization. To create optimal physical properties of the air and its chemical composition, all premises of the pre-

school organization should be ventilated daily. Airing is carried out at least 10 minutes every 1.5 hours.

In the rooms and bedrooms in all climatic regions, except IA, IB, ID sub areas, natural through or angular ventilation is provided. Through ventilation is not carried out in the presence of children. Airing through the toilet rooms is not allowed. In the presence of children, one-sided aeration of all premises in the warm season is allowed. The duration of ventilation depends on the temperature of the outside air, wind direction, efficiency of the heating system. Airing is carried out in the absence of children and ends 30 minutes before they come from a walk or classes. When ventilating, a short-term reduction in the room air temperature is allowed, but not more than 2–4°C. In the bedrooms, through ventilation is conducted until daytime sleep. When ventilating during sleep time, the vent windows are open on one side and close 30 minutes before awaking. In the cold season, transoms and windowpanes are closed 10 minutes before bedtime for children. In the warm season, sleep (day and night) is organized with open windows (avoiding draft).

The values of the air temperature and air exchange rate per 1 hour should be taken in accordance with the requirements for the air temperature and air exchange rate in the main premises of preschool educational organizations in different climatic regions (Tab. 14).

Relative air humidity in the areas with the stay of children should be within 40–60%.

Revision, cleaning and monitoring of the existing ventilation systems efficiency are carried out at least once a year.

PRACTICAL PART

1. Carry out sanitary-hygienic examination of the floor plan of the PSEO project according to the scheme, by filling in the table 15.

Give a written opinion on the project; note the adherence to the principle of group isolation, sufficiency of the set of rooms, and sufficiency of the room area in the PSEO. After assessing a presence and the severity of deviations from SNiP and SanPiN in terms of potential harmful impact on children's health, conclusion is made as to approve or reject the project, or the project should be returned for revision.

Norms for temperature and air exchange rate in the indoor areas of preschool educational organizations

Rooms	t° (C) no less than	Air exchange rate per hour			
		IA, IB, ID climatic regions		Other climatic regions	
		inflow	outflow	inflow	outflow
Reception, playing rooms of younger children	22–24	2.5	1.5	-	1.5
Reception, playing room of junior, middle and senior children	21–23	2.5	1.5	-	1.5
Bedrooms of all age groups	19–20	2.5	1.5	-	1.5
Toilets for younger children	22–24	-	1.5	-	1.5
Toilets for preschool children	19–20	2.5	1.5	-	1.5
Premises for medical purposes	22–24	2.5	1.5	-	1.5
Halls for music and gymnastics classes	19–20	2.5	1.5	-	1.5
Walking veranda	≥ 12	As indicated, but no less than 20 m ³ per 1 child			
Hall with a bathroom pool	≥ 29				
Dressing room with shower pool	25–26				
Heated corridor transitions	≥ 15				

QUESTIONS FOR SELF-CONTROL

1. Hygienic principles of placement and planning of PSEO.
2. Hygienic requirements for the placement of PSEO.
3. Hygienic requirements for the zoning PSEO land.
4. Sites for children: the required number, area norms, equipment.
5. Physical culture platform: accommodation, equipment.
6. Sanitary and hygienic recommendations for the landscaping the land plot of PSEO: percentage of gardening, placement of green plantations.
7. Economic zone: location, purpose.

Scheme for assessing internal planning of preschool educational organization

Indicators	Norms by SNIp and SaNPiN	The project data	Opinion
Number of floors	≤ 3		
Number of younger age groups	From table 12		
Number of senior age groups	From table 12		
Number of entrances for children	1 per 4 groups		
Room for toddler children: a) reception room b) playing-dining room c) bedroom d) buffet e) toilet	18 m ² 2.5 m ² per child 1.8 m ² per child 3 m ² 12 m ²		
Room for preschool children: a) dressing room b) group room c) bedroom d) buffet e) toilet	18 m ² 2 m ² per child 2 m ² per child 3 m ² 16 m ²		
Height of rooms	3 m		
Light coefficient in a group room	1:4		
Orientation of windows of the main rooms	Optimal		
Hall for musical and gymnastic exercises	For toddler groups up to 120 places – 1 (75 m ²); for PSEO of larger capacity – 2 halls (75 m ² each)		
Medical unit: * a) medical office b) procedure room c) toilet	12 m ² 8 m ² 6 m ²		

QUESTIONS FOR SELF-CONTROL (CONTINUATION)

8. Hygienic requirements to the building of PSEO: configuration of the building, number of floors, groups of indoor areas.
9. Universal rooms of a PSEO: composition and area of rooms, equipment of rooms for children of toddler and preschool age.
10. Hygienic requirements for the composition and placement of rooms for music and gymnastics classes.
11. Hygienic requirements for related facilities (medical unit, nutrition unit, laundry room).
12. Hygienic requirements for indoor lighting conditions of PSEO.
13. Hygienic requirements for ventilation and microclimate of the main indoor areas of PSEO.

TEST TASKS

Choose one correct answer

1. ROOM OF A KINDERGARTEN HAVING IMMEDIATE CONNECTION TO THE OTHER ROOMS IS:
 - 1) playing-dining room
 - 2) bedroom
 - 3) toilet
 - 4) dressing room
2. ROOM FOR CHILDREN OF PRESCHOOL AGE INCLUDES:
 - 1) reception room
 - 2) gym room
 - 3) playing-dining room
 - 4) bedroom
3. LIGHT COEFFICIENT IN A GROUP ROOM OF A PRESCHOOL EDUCATIONAL ORGANIZATION SHOULD NOT BE LESS THAN:
 - 1) 1:4
 - 2) 1:6
 - 3) 1:8
4. PART OF THE MEDICAL UNIT:
 - 1) dentist's office
 - 2) insulator

3) room for physiotherapeutic procedures

5. THE AREA OCCUPIED BY BUILDINGS ON THE LAND OF A PRESCHOOL EDUCATIONAL ORGANIZATION SHOULD NOT EXCEED:

1) 10–12%

2) 15–18%

3) 50–60%

6. ON THE FIRST FLOOR OF A PRESCHOOL EDUCATIONAL ORGANIZATION SHOULD BE PLACED:

1) rooms for preschool children

2) medical office

3) director's office

SITUATIONAL PROBLEM

Preschool educational organization №15 of the city N is located on the border of the micro district and is located 150 meters from the industrial enterprise of the third hazard class. The PSEO has an angular location to the micro district.

On the territory of the site there are kindergarten sites, calculated for each group of the PSEO, there is a general sports ground, a hotspot zone. The zone of green plantations is 33%.

Evaluate the presented plan of the PSEO as to accordance with the sanitary and hygienic requirements.

3. SANITARY-HYGIENIC EXPERTISE OF THE PROJECTS OF EDUCATIONAL ORGANIZATIONS (SCHOOLS)

The objective of the lesson is to familiarize students with the hygienic principles of placement, planning, improvement of educational organizations (schools).

Types of schools. A school is an educational institution aimed for organized education, and upbringing of the younger generation and working with youth.

Depending on the source of funds thanks to which the school exists, it may be a state, municipal (local government) or private, held by public, religious organizations or individuals.

Schools are divided into types as follows:

- By the nature of knowledge being taught – into general and vocational schools;

- By the level of education – into primary, incomplete secondary and secondary schools;

- In relation to religion – into secular and confessional (church, religious) schools;

- By sex of students – for male, female and co-educational schools.

The goals, objectives and content of the school's work depend on the level of development of society, its class structure. The content of education and the organization of instruction in the national school vary with the development of society, level of progress of science and culture, but the fundamental principles of its activities remain unchanged.

In USSR, the universal initial compulsory education was carried out since 1934, eight-year education since 1962, and secondary education since 1976.

The secondary school provides students with systematic knowledge of the basic sciences, as well as relevant skills that are necessary for further vocational training and higher education.

Currently, there are several types of schools (Tab. 16):

1. General education schools, where children spend 4–6 hours daily.
2. Extended day schools which include not only the educational process, but also upbringing, and where the schoolchildren spend 8–10 hours a day.

Table 16

Types of schools, their capacity and land area

Schools	Total number of pupils	Stream ratio of 1–4th, 5–8th, 9–11th classes (school years)	Land area, ha
Primary schools for 4 classes	40	1:00:00	
for 4 classes	80	1:00:00	0.5
Incomplete secondary (nine-year)			
for 8 classes	192	1:01:00	1.2
for 8 classes	320	1:01:00	1.7
Secondary schools			
for 10 classes	392	1:01:01	2
for 12 classes	464	1:01:02	2
for 16 classes	624	1:02:02	2
for 20 classes	784	2:02:02	2.2
for 30 classes	1176	3:03:03	2.8
for 40 classes	1568	4:04:04	3
for 50 classes	1960	5:05:05	4

3. Boarding schools with round-the-clock stay of students.

4. Evening shift schools for working teenagers, where classes are held 3–4 times a week for 4–5 hours.

The prototype of a school today is a general polytechnic school with an extended day. The capacity of a newly built urban general education organizations should be calculated for training in only one shift. Table 16 shows the data for schools currently in operation.

Depending on the state of health of the student population, three types of schools are identified:

1. General education schools for practically healthy children.

2. Schools for children with disabilities – blind and visually impaired, hard of hearing, deaf and dumb, mentally retarded.

3. Schools of sanatorium type for children with weakened health – neurotics, suffering from chronic rheumatism, having suffered poliomyelitis, with tuberculous intoxication.

There are schools with in-depth study of certain subjects – humanities, foreign languages, mathematics, etc.

The length of stay of students in the school and the academic load determine the composition of the premises and the structure of the buildings of these types of schools. All regulations on the arrangement and equipment of the territory, buildings and premises of newly constructed and reconstructed schools should be adopted in accordance with SanPiN 2.4.2.282110 “Sanitary-epidemiological requirements to conditions and organization of education in general education organizations”.

Requirements for placement of general education organizations.

Buildings of general education organizations should be located in the residential zone, outside the sanitary protection zones of enterprises, garages, parking lots, motorways, railway transport facilities, underground, take-off and landing routes for air transport. Main engineering communications of urban (rural) use – water supply, sewerage, heat supply, energy supply – should not pass through the territory of general education organizations.

In case of a city, the placement of schools is such, that residential houses are located along the perimeter of the school site and removed from the red line by 25 meters, whereas the transport highways are removed by more than 100 meters. It is better to place boarding schools near parks and woodlands.

The need for the deployment of school places is determined by the age structure of the population, taking into account the coverage of 100% of children aged 7 to 15 years with 8 years of education and at least 80% of children of senior school age – for secondary education. The network of schools is planned at the rate of 160 places per 1000 population in case of eight-year schools and boarding schools, about 30 places in the upper grades of general education schools, and 6–8 places in case of evening schools.

The school's maintenance radius should ensure pedestrian accessibility, taking into account the age of children, climatic features of the construction area. In a city, the radius of service for schools should be:

- in II and III construction and climatic zones – no more than 0.5 km;
- in I climatic region (I subzone) for pupils of 1–9th grades – no more than 0.3 km, for pupils of 10–11th grades – no more than 0.4 km;

- in I climatic region (II subzone) for pupils of 1–9th grades – no more than 0.4 km, for students of 10–11th grades – no more than 0.5 km.

In rural areas pedestrian accessibility for students of general education organizations:

- in II and III climatic zones for students of the 1–4th grade is no more than 2.0 km; for pupils of grades 5–11, no more than 4.0 km, in I climatic zone – 1.5 and 3 km, respectively.

At distances greater than indicated for general educational institutions specifically in rural areas, it is necessary to arrange transport services for the general education organization and back. The journey time should not exceed 30 minutes one way.

Transportation of students is carried out by specially allocated transport, intended for transportation of children.

The optimal pedestrian approach for students to the pick-up point at the stop should be no more than 500 m. For rural areas, it is allowed to increase the radius of pedestrian access to a stop of up to 1 km.

For students who live at a distance above the maximum allowable transport service, as well as when transport is unavailable during a period of unfavorable weather conditions, a boarding school is provided in the general education organization.

Hygienic requirements for the school land. The plot area depends on the number of students (Tab. 16), but should be at least 0.5 hectares. The area is calculated from 20 to 53 m² per student; in boarding schools – from 50 to 71 m².

The site must be fenced, landscaped and divided into zones:

- Building zone (10–12%);
- Physical culture and sports;
- Recreation;
- Economic;

The allocation of the training and experimental zone is allowed.

The territory should be planted at the rate of 50% of the area free from construction, including the perimeter of the territory. For the regions of the Far North, as well as in cities under conditions of a dense urban development, a reduction of gardening by 25–30% of the area free from building is allowed. The width of the green strip along the border of the site is at least 1.5 m, on the street side – at least 6 m. The distance from the school building to the trees is not less than 15 m, to the bushes – 5 m. The area of

greenery includes a plot of fruit and berry plants educational and experimental zone, shrubs, trees, lawns. In gardening it is forbidden to use trees and shrubs with poisonous fruits, poisonous and thorny plants.

Athletic and sports zone is 40–50% of the site area, includes grounds for sports games, gymnastics, track and field athletics, combined volleyball and basketball courts, and table tennis courts. The sports ground for ball games should be placed at least 25 m from the school building or separated by a protective strip of high-standing green spaces. Sports grounds are positioned along the long axis from the north to south, so that the sun's rays do not dazzle the children during classes. All sites must have a hard surface, a football field – a grassy cover. Synthetic and polymer coatings must be frost-resistant, equipped with drains and should be made of materials that are harmless to the health of children. Classes on wet sites with irregularities and potholes are not conducted.

Athletic and sports equipment should correspond to the growth and age of students. It is allowed to use sports facilities (platforms, stadiums) located near the institution and equipped in accordance with the sanitary and epidemiological requirements for the arrangement and maintenance of places for physical culture and sports.

The recreation area is a platform for mobile games and recreation for students attending groups of extended days, as well as for outdoor activities. They are placed near the exits from the school building. The sites must be plain, with a sandy or naturally turfy surface. Their area is calculated for junior classes as 100 m², and for secondary and senior classes as 25 m² per class.

The economic zone is located at the entrance to the production premises of the dining room and has an independent entrance from the street.

In the economic zone there is a garbage collection platform at a distance of at least 20 m from the building. On a paved area, containers with tightly closing lids are installed. The dimensions of the site should exceed the base area of the containers by 1.0 m from all sides. Garbage containers are located at a distance of at least 25 m from the school building.

The composition of the training and experimental zone includes the areas of vegetable and field crops, the orchard, greenhouses, zoological, meteorological and geographical sites, as well as the ground for outdoor classes (with a canopy).

Entrances to the territory, driveways, paths to economic buildings, to sites for garbage cans are covered with asphalt, concrete and other hard surfaces.

On the territory of newly constructed buildings for general education organizations, there are parking lots of vehicles intended for the transportation of students, including trainees with disabilities.

The territory of the institution must have external artificial lighting. The level of artificial illumination on the ground must be at least 10 lux.

Hygienic requirements for the school building. New types of general education schools (lyceums, gymnasiums, private schools) must have either a separate building or be located in separate compartments with an isolated entrance on the basis of the general school functioning.

The basic hygienic principles of design and construction of general education schools include the creation of conditions for:

- 1) Conducting the educational process;
- 2) Comprehensive physical education of children;
- 3) Child nutrition;
- 4) Organization of the extended day;
- 5) Children rest;
- 6) Organization of mass cultural and out-of-school activities of children;
- 7) Full-fledged natural and artificial lighting;
- 8) Optimal air-thermal regime;
- 9) Isolation of certain groups of children in case of infectious diseases in order to prevent their spread to the whole team.

An important principle of the architectural and planning decision of the school building is the maximum division of the children into separate age groups for the differentiation of the educational process, conditioned by the special features of the development and functional state of the children.

In addition, the structure of the school building should provide:

- Separation of classrooms from general schools that are sources of noise, dust and other air pollution: gymnastics and assembly halls, workshops, kitchens, utility rooms;
- Convenient and rather short communications of educational and recreational facilities, especially the primary classes, with wardrobes and a plot of land used for having a rest during breaks.

The composition of the building should provide a compact layout with preservation of section principle. This requirement is most responsive to the block or sectional building system – the presence of several 2–3 storey buildings, interconnected by warm transitions. With this structure of the school building, educational facilities for children of different age groups are placed in separate blocks; school premises are also allocated in a separate unit. In the southern areas the school can consist of separate buildings (pavilions).

Currently, schools are designed with not more than 3 floors, and optimally 2-floor, in large cities – no more than 4 floors.

On the 1st floor there are premises used by all classes: workshops, offices – military, technical training facilities and a biology laboratory; on the 2nd floor – classrooms for 4–7 classes; on the 3rd floor – for 8–11 grades; on the 4th floor – no more than 25% of classrooms, it is not allowed to arrange there classrooms for 1st classes.

It is recommended to place educational facilities for students of 1st grades not higher than on the 2nd floor, and for students of 2–4 grades not higher than on the 3rd floor.

Training facilities are not allowed to be placed on the basement floor.

The set of premises should create conditions for studying compulsory academic disciplines (taking into account national and regional specifics), as well as additional subjects for the choice of students in accordance with their interests and differentiation in the directions for in-depth study of one or two or three subjects.

The premises of the school are divided into:

- Basic;
- Auxiliary;
- Service;

The main educational facilities are the classroom, study room, laboratory, workshops, sports hall. The auxiliary rooms include dining room, library, corridors and recreational facilities, an entrance hall with a wardrobe, and toilets. Office premises are the office of the director, teacher's office, medical center.

Classrooms for primary classes are recommended to be allocated in a separate block (building), grouped into training sections.

In the training sections (blocks) for students of the 1st and 4th grades there should be educational facilities with recreational facilities, playrooms

for groups of extended day (at least 2.5 m^2 per student), and bathrooms. In the training section for the first-year students attending the extended-day groups, there should be sleeping rooms with an area of at least 4.0 m^2 per child.

Training sections for students of 2–4 grades are designed for no more than 6 classes including a workshop for labor training, a universal room for extended day, recreational facilities, and toilets. For students of the 5–9th and 10–11th grades, educational activity is organized according to the classroom system. Training sections for students of the 5–9th and 10–11th grades consist of study rooms, laboratories with laboratory assistants, recreations, and toilets.

In rural schools with small occupancy of classes it is allowed to use classrooms for two disciplines, for example, chemistry-biology; mathematics-drawing; history-geography; literature-foreign language.

The area of the classrooms is taken excluding the area necessary for the placement of additional furniture (cabinets, pedestals and others) for the storage of teaching aids and equipment used in educational activities, based on:

- at least 2.5 m^2 per 1 student with frontal classes;
- at least 3.5 m^2 per 1 student when organizing group work forms and individual classes.

The estimated number of students in classes is determined on the basis of the norms of the area per 1 student accounting for placement of furniture.

Training facilities include:

- Working area of students; the optimum dimensions of the working area depend on the angle of visibility associated with the distance from the board to the first lateral rows of desks, it should be at least 35° for students of the II–III level of education and at least 45° for students in the first stage of education;
- Teacher's working area;
- Additional space for the placement of educational and visual aids and technical training aids;
- Zone for individual classes of students and other possible activities.

The area of the classroom and study room is 60 m^2 , laboratories 66 m^2 , laboratory technician room from 16 to 32 m^2 . The form of the classrooms is rectangular with 3:4 aspect ratio and the placement of windows

along one of the long sides, or square. Entrances to classrooms should be provided from the front tables and desks.

For in-depth study of individual subjects and practical classes, it is necessary to divide the class into 2–4 subgroups. When building schools that are oriented towards an in-depth and expanded training, it is necessary to provide premises for studios (universal halls) with dimensions of 12x12 m, as well as auxiliary rooms for the department for artistic education and art: aesthetics office, fine arts, choreography, singing and music classes (70–108 m²), depending on the purpose of the new educational institution.

In engineering schools universal room area of 108 m² (90 + 18) should be provided for technical creativity.

Educational and art rooms should have zones for watercolor painting, oil painting and drawing. Depending on the posture while painting (watercolor painting and drawing is done in while sitting, oil painting is one while standing), the area per 1 workplace should be for oil painting – 3.5 m², for watercolor painting and drawing – 2 m². In schools with in-depth study of disciplines, one should have a lecture hall. Its dimensions are set at a rate of 1 m² per place.

The height of classrooms is 3 m.

To accommodate classrooms in the school building, it is recommended to follow the age principle. The offices should have vertical and horizontal connections between themselves. The most perfect cathedral principle is the placement of classrooms, in which specialized sections are created from the offices of the natural-mathematical and humanitarian cycles; communication between them is provided vertically. Horizontal connections between the offices are carried out in large schools when students from 2–3 adjacent classes are placed on the same floor.

For laboratory work, laboratories for physics, astronomy, chemistry, and biology with a laboratory technician, located on the side of the demonstration table, are being designed. The laboratory should have a second exit to the corridor. Laboratories for convenience of gas, water, and exhaust ventilation are placed in one wing of the building one above the other. On the top floor there is a chemical laboratory with independent exhaust ventilation, on the 1–2th floor – a biological laboratory.

Per each classroom or 2–3 classrooms, a laboratory is organized. The presence of a laboratory is necessary in the classrooms of chemistry, physics, biology, computer science. In the school for 8 classes, 2 laboratory assistants are allowed. The number of laboratories depends on the school's

fullness. In 8-year schools for 192 and 320 students, 1 laboratory is designed for classes in physics, chemistry and biology and 2–3 laboratory specialists, respectively. In secondary school there are 2 laboratories for 10 classes: physics, chemistry and biology. In a school for 20 classes there should be 3 laboratories, for 30 classes – 4, for 40 classes – 5 and for 50 classes – 7 with their laboratory assistants.

Classrooms of computer science and computer technology schools are not allowed to be placed in basement rooms. They should not be adjacent to rooms where the noise and vibration levels exceed the standard values (gyms, workshops). The area for 1 workplace with a video display terminal should be at least 4.5 m^2 . When building new and reconstructing existing educational institutions, computer classes should be designed at a height of at least 4 m. Computer classrooms or display auditoriums (classes) must have an adjacent room – laboratory technician room with an area of at least 18 m^2 with two entrances to the training room and the stairwell or in recreation.

For pupils of 2–4 grades a workshop for labor training and socially useful labor with an area of 80 m^2 is provided. Older boys have their classes at training workshops for processing metal and wood (66 m^2) with a common instrumental (16 m^2) and a storeroom for storage of finished products, for girls of grades 5–9 – there should be at least two rooms for training the skills of cooking food (50 m^2) and for cutting and sewing (72 m^2) and cooking with an auxiliary room (16 m^2). Premises for labor training may be located in the basement with mandatory natural lighting or in a separate building (in this case, they are equipped with a dressing room and bathrooms).

The room for the extended-day groups is designed based on 20% of the total number of students in grades 1–4, and 10% of students in grades 5–7 and 2 m^2 per 1 student. In schools for grades 8–12 there is 1 room with an area of 60 m^2 and an inventory of 5 m^2 . In schools for 16–20 grades, 2 rooms of 52 m^2 or 60 and 30 m^2 with inventory are designed. Then, for every 10 classes, one room with an area of 50 m^2 is added. For first-year students attending an extended-day group, they organize sleeping rooms, separate for boys and girls. They are equipped with teenage (size $1600 \times 700 \text{ mm}$) or built-in single-tier beds.

The gym hall is located on the 1st floor. When placing the sports hall on the 2nd floor, the standard levels of sound pressure and vibration should be ensured in accordance with hygiene standards. The height of the

sports hall is 6 m. The following sizes of educational and sports halls are accepted: 9x18 (162 m²) – for schools for 10–16 classrooms; 12x24 (288 m²) – in the school for 20–30 classrooms. In schools for 40–50 classrooms, 2 halls are projected: 144 and 288 m² or 144 and 450 m². Small halls are used for classrooms of junior classes. At the gyms, dressing rooms (2 to 14 m²) are designed for boys and girls with showers (2 to 12 m²) and latrines (2 to 8 m²); instructor's room (89 m²), projectile (1632 m² depending on the area of the gym, adjacent to the hall), premises for storage of cleaning equipment and preparation of disinfecting and cleaning solutions with an area of 4.0 m². In the composition of premises for sports and sporting purposes, it is necessary to include a room equipped with training devices, and, if possible, a swimming pool.

Auxiliary facilities are wardrobes, recreation, dining room, assembly hall, library, bathrooms.

Wardrobes in schools should be located on the 1st floor with mandatory equipment for each class, or they are allowed in the basement. Wardrobes should be equipped with clothes hangers and shoe boxes. It is strictly forbidden to arrange wardrobes in classrooms and recreations.

Recreations are designed for the rest of children during a break. Recreations can be in the form of corridors or halls.

The width of recreations for unilateral arrangement of classes should be not less than 4.0 m, with a bilateral arrangement of classes – not less than 6.0 m.

The recreational area should be 0.6 m² per student. The area of recreation-halls – 2 m² per 1 student.

Nutrition unit. In general educational institutions, twice-a-day hot meals for children of extended-day groups and hot breakfasts for other children should be organized. Meals can be arranged in the dining room, cooked of raw materials or semi-finished products. School canteen, where they use raw materials, should have the following set of facilities and equipment:

- Shops: for processing vegetables, the billet, the hot;
- Washing room of tableware and kitchen utensils;
- Pantries of dry foods and vegetables;
- Refrigerated chambers for the storage of perishable products;
- Household facilities for the personnel of nutrition unit;
- Loading and container area;

- Washing room for containers;
- Cold store for food waste;
- Bathroom for the kitchen staff;

The composition of premises of a school canteen dealing with semi-finished products should include a hot shop, food completion shop, washing room for tableware and kitchen utensils, storage room for dry foods and vegetables, refrigerators for semi-finished foods, household rooms for the staff, loading-packing area, container washing area, refrigerating chamber for food waste.

The premises of the buffet-dispenser should include loading area, equipped with a stove for heating food, refrigerated cabinets; dispensing area, equipped with marmites; dishwasher; ancillary facilities, household facilities for staff, premises for containers washing.

School buffets and dining rooms have to have an area of 0.7 m^2 per 1 seat, provided 100% of the students divided for three consequent streams are able to take a seat and have a dinner.

At dining rooms there should be installed hand washers, specifically 1 tap for 20 seats. The hand washers are placed in extended aisles, corridors leading to the dining room, or in a separate room next to the dining room.

In rural schools (secondary, incomplete secondary), the requirements for catering are the same as in urban schools.

In small schools (up to 50 pupils) it is necessary to allocate rooms for food intake with a minimum set of equipment: 2-nest electric stove, dishwasher, refrigerator, boiler.

Assembly hall. Hall dimensions are determined by the number of seats at the rate of 0.65 m^2 per 1 seat and 60% of the total number of places in the school, and in boarding schools – 50% of the total number of students. In schools for 8 classes, assembly hall with gymnastics equipment is allowed. There should be at least 2 exits in the assembly hall. At an assembly hall, there should be at least 10 m^2 of artistic lavatories, a projection room of 27 m^2 , a storehouse for decorations, musical instruments with an area of 10 m^2 , a storage area for suits of 10 m^2 .

Library. The type of library depends on the type of general education institution and its capacity. In schools of a new type, the library should be used as a reference and information center equipped as to provide necessary conditions for individual classes of students. The area of the library (information center) should occupy at least 0.6 m^2 per student. The follow-

ing areas should be provided in the library: reading rooms, information point (issuance and reception of literature), places for working with catalogs, open access funds, closed storage funds, zones for individual classes with electronic resources.

Bathrooms. On each floor near the classrooms it should be placed separately for boys and girls, equipped with cabins and doors. In school toilets there must be 1 toilet for 20 girls, 1 washbasin for 30 girls, 1 toilet and 1 urinal and 1 washbasin for 30 boys. For the personnel of the school, there is a separate lavatory with a washbasin of 1 toilet bowl for 20 people.

The washroom is located in front of the toilet and there must be gateway that insulates the toilet from other premises of the school. It is not allowed to place entrances to toilets and washrooms for students directly from stairwells and against entrances to educational and sleeping rooms. The total area of washrooms and toilets is calculated at the rate of 0.1 m^2 per student. For pupils of the 5th and 11th grades, personal hygiene rooms should be arranged for girls at the rate of 1 cabin per 70 people with an area of at least 3 m^2 . They are equipped with a bidet or a tray with a flexible hose, toilet and washbasin with hot and cold water.

In the premises of primary classes, laboratory, teaching rooms (chemistry, physics, drawing, biology), workshops, home economics offices, washbasins are installed in all medical facilities.

On each floor there are rooms equipped with pallets and cold and hot water supply for them, for processing and storage of cleaning equipment, preparation of disinfectant solutions.

The office premises include a teacher's room, a director's office, and a medical center. Teacher's room is located on the second floor in the center of the school building, its area is calculated at the rate of $1.5\text{--}2.5 \text{ m}^2$ per class. A medical office in newly constructed schools should include the following facilities:

- Doctor's office with a length of at least 7.0 m (to determine the severity of hearing and sight of students), an area of at least 21.0 m^2 ;
- Treatment room with an area of at least 14.0 m^2 ;
- Vaccination room with an area of at least 14.0 m^2 ;
- Room for the preparation of disinfectant solutions and storage of cleaning equipment intended for medical premises with an area of at least 4.0 m^2 ;
- Toilet area of 2 m^2 ;

The surface of walls, floors and ceilings of medical premises (doctor's office, procedural rooms) should be smooth, easily accessible for wet cleaning and resistant to treatment with detergents and disinfectants. Washbasins with hot and cold water supply must be installed in medical facilities.

When equipping the dental office, its area must be at least 12.0 m².

For children in need of psychological and pedagogical assistance, separate offices of a teacher-psychologist and a speech therapist are provided in general education organizations.

All medical facilities should be grouped in one block and placed on the 1st floor of the building.

The office of the director and the general documentary office are located on the 1-floor, can be adjacent, with an area of 12 and 10 m², respectively.

Hygienic requirements for school microclimate. Depending on the climatic conditions the air temperature in the classrooms, offices of the psychologist and speech therapist, laboratories, assembly hall, dining room, recreation, library, lobby, wardrobe should be 18–24°C; in the gym and rooms for creative training, workshops – 17–20°C; in the bedroom, playrooms, premises of pre-school education and boarding school – 20–24°C; in medical rooms, in the gymnasium's locker rooms – 20–22°C, in shower rooms – 24–25°C, in sanitary units and personal hygiene rooms, the air temperature should be 19–21°C, in the shower – 25°C. To control the temperature regime, classrooms should be equipped with household thermometers.

In the schools, the relative humidity of the air should be 40–60%, the speed of the air movement is no more than 0.1 m / sec.

Training facilities are ventilated during breaks, and recreational – during the lessons. Prior to the beginning of classes and after their termination, it is necessary to carry out through ventilation of classrooms. The duration of through ventilation is determined by weather conditions, direction and speed of wind movement, efficiency of the heating system. The recommended duration of through ventilation is shown in Table 17.

Lessons on physical culture and sports classes should be conducted in well-aerated gym halls.

It is necessary to open one or two windows on the leeward side at an outdoor temperature above +5°C and a wind speed of no more than 2 m/s.

Recommended through-ventilation time depending on the outdoor temperature

Outdoor temperature, °C	Airing duration, min	
	during short breaks	during long breaks and between the shifts
From +10 to +6	4–10	25–35
From +5 to 0	3–7	20–30
From 0 to -5	2–5	15–25
From -5 to -10	1–3	10–15
Below -10	1–1.5	5–10

At a lower temperature and faster air movement, classes in the hall are conducted with one or three transoms open. At an outside air temperature below -10°C and an air speed of more than 7 m/s, the through ventilation of the room is conducted in the absence of students for 1–1.5 minutes; in great changes and between shifts – 5–10 minutes.

When the air temperature reaches $+14^{\circ}\text{C}$, ventilating of the gym should be discontinued.

The windows must be equipped with folding transoms with lever devices or pegs. The area of the transom and ventilators used for ventilation should be at least 1/50 of the floor area in the classrooms.

Hygienic requirements for natural and artificial illumination of indoor school areas.

Daylight. All school buildings should have natural lighting. Without natural light, it is allowed to design shells, washrooms, showers, restrooms at the gym, latrines and showers of personnel; storerooms and warehouses (except for premises for storage of flammable liquids); radio nodes; a cinema-photo laboratory; book depositories; boiler, pumping water supply and sewage; air conditioning and ventilation chambers; control units and other premises for installation and management of engineering and technological equipment of buildings; premises for storage of disinfectants.

In the classrooms, side left-hand lighting should be designed. In educational facilities with a depth of more than 6 m, a right-sided lateral illumination device is required, the height of which should be at least 2.2 m

from the floor. In this case, the direction of the main luminous flux in front and behind the students is unacceptable.

Two-way side natural lighting can also be used in training workshops, assembly halls and gyms.

The unevenness of the natural lighting of the premises intended for the study of students should not exceed 3:1.

For decoration of educational premises, finishing materials and paints should be used to create a matte surface with reflection coefficients: for the ceiling – 0.7–0.8; for walls – 0.5–0.6; for the floor – 0.3–0.5.

The following colors of paints should be used:

- for the walls of the classrooms – bright colors of yellow, beige, pink, green, blue are recommended;
- for furniture (desks, tables, cabinets) – the colors of natural wood or light green;
- for blackboards – dark green, dark brown;
- for doors, window frames – white.

To maximize the use of daylight and uniform lighting of classrooms, it is recommended:

- To place plant trees no closer than 15 m, shrubs – no closer than 5 m from the building;
- Do not paint the window panes;
- Do not put flowers on the windowsills. They should be placed in portable florists 65–70 cm high from the floor or suspended pots in the piers of windows;
- Window cleaning is carried out 2 times a year (in the autumn and in the spring).

The windows of classrooms should be oriented to the southern, southeastern and eastern sides. Windows of art classrooms and kitchen rooms can be oriented on the north side. The orientation of the windows of the computer rooms is to the north, north-east. In buildings, especially with a large area of glazing (ribbon windows), it is mandatory to use adjustable sunscreens to eliminate direct and reflected glare, high brightness in the field of view and overheating of rooms: blinds, fabric curtains of light tones, combined with the color of walls and furniture. It is forbidden to use curtains made of polyvinyl chloride film. In the non-working condition, curtains must be placed in the piers between the windows.

The natural illumination coefficient (NIC) for classes, study rooms and doctor's office should be at least 1.5%. The most effective amount of light flux penetrates through the top of the window, in this regard, the most suitable windows are rectangular; the device of windows of an oval or gothic form is inadmissible. It is recommended that the ratio of the glazing area to the floor area (light coefficient – LC) for the main premises of the school be at least 1:6. The width of the piers in the light-bearing wall should not be more than 50 cm. The height of the window sills in the school should be 0.7–0.8 m.

Artificial lighting. In the classrooms, the system of general lighting is provided with ceiling lamps with fluorescent lamps and LEDs. Lighting is provided with the use of lamps in the spectrum of color emission: white, warm white, natural white.

Light sources of a different nature of radiation are not used in the same room for general illumination.

In educational rooms, classrooms, laboratories, the levels of illumination should meet the following standards: on the desktops – 300–500 lux, in the rooms of technical and art drawing – 500 lux, in the offices of computer science on the tables – 300–500 lux, on the class board – 300–500 lux, in the assembly and sports halls (on the floor) – 200 lux, in recreations (on the floor) – 150 lux.

When using computer technology and there is a need to combine the perception of information from the screen and the recording in the notebook – illumination on the tables of students should not be less than 300 lux.

PRACTICAL PART

1. Carry out sanitary-hygienic examination of the school building project according to the scheme by filling in the table 18.

When analyzing the project of the school building, evaluate the construction of the school building (centralized, block, pavilion), the number of floors in the building, the distribution of rooms by floors, the adequacy of the premises, their location and area, and the indicators of natural light. The evaluation of each of the issues considered is carried out by comparison with the existing norms for design of schools.

1. Give a written opinion on the reviewed project: first, it is necessary to list all sanitary deficiencies or comments, justifying them with a reference to the SanPiN, then, preliminarily assessing the severity of the sanitary deficiencies, decide whether to approve or reject the project.

The second part of the conclusion is formulated clearly, for example: "The project is coordinated" or "The project is returned for revision taking into account the above remarks" or "The project is rejected".

QUESTIONS FOR SELF-CONTROL

1. Classification of types of schools depending on the state of health of students, time of stay, etc.

2. Requirements for accommodation, pedestrian and transport accessibility for schools.

3. Zoning of school territory, percent of building and gardening.

4. Hygienic requirements for the placement and equipment of physical culture, sports, economic, training and testing and other areas.

5. Structure, number of floors of a school building.

6. The main indoor areas of the school. Hygienic requirements for classrooms.

7. Placement, planning of the sports hall of the school.

8. Requirements for the auxiliary premises of the school (wardrobes, recreation, dining room, etc.).

9. School premises. Hygienic requirements for placement and composition of medical facilities, norms of their area.

10. Hygienic requirements for the air-thermal regime, the mode of ventilation of the school indoor areas.

11. Hygienic requirements for conditions of natural and artificial illumination of school indoor areas.

Table 18

Scheme of evaluation of the school building project

Indicator	Norms by SaNPiN and SNiP	The project data	Opinion
Composition of the school building	1. Centralized 2. Block 3. Pavilion		
Number of floors in the building	2–3 (4)		
Number of classes (grade 1–4)	Refer to table 16		
Characteristics for a typical classroom of primary school:			
Area	60 m ²		
Height	3 m		
Orientation	S (SE, E)		
Light coefficient	1/6		
Characteristics for a classroom (by choice):			
Area	60–66 m ² and more		
Height	3 m		
Light coefficient	1/6		
Characteristics for a laboratory (by choice):			
Main room area	no less than 66 m ²		
Laboratory area	16–32 m ²		
Sports Hall:			
Location:	in separate building or on the 1-st floor		
Height	6 m		
Daylight access	2-side		
Dressing rooms	2 × 14 m ²		
Showers	2 × 12 m ²		
Toilets	2 × 8 m ²		
Sportive inventory	16–32 m ²		

Table 18 (continuation)

Room for storage of cleaning equipment, preparation of disinfectant and cleaning solutions with area			
Instructor-Teacher's room	9 m ²		
Indoor recreational areas:			
Corridors:			
- width	2.8 m		
- area per 1 pupil	0.6 m ²		
Halls:			
- width	4 m		
- area per 1 pupil	2 m ²		
Sanitary facilities (latrines, toilets) for students	no less than 2 for each floor		
Room for personal hygiene	1 cabin 3 m ² per 70 persons		
Bathroom for staff	1 on any floor		
Medical office:			
Doctor's office:			
- area	21 m ²		
- length	7 m		
The dentist's office	12 m ²		
Procedural	14 m ²		
Vaccination cabinet	14 m ²		
Psychologist's room	10 m ²		
Room for the preparation of disinfectant solutions and storage of cleaning equipment	4 m ²		
Toilet	no less than 2 m ²		

TEST TASKS

Choose one correct answer

1. OPTIMAL ORIENTATION OF CLASSROOM WINDOWS IN A SCHOOL IS

- 1) south
- 2) east
- 3) west
- 4) north

2. ONE OF THE BASIC ROOMS OF A SCHOOL IS

- 1) library
- 2) workshop
- 3) dining room
- 4) medical point

3. SCHOOL WARDROBE SHOULD BE PLACED

- 1) on the 1st floor
- 2) in a recreation
- 3) in the classroom

4. MAXIMAL COUNT OF PUPILS IN A SCHOOL CLASS

- 1) 15 students
- 2) 20 students
- 3) 25 students
- 4) 30 students

5. REFERS TO THE BASIC ROOMS OF A SCHOOL

- 1) library
- 2) wardrobe
- 3) medical point
- 4) sports hall

6. SCHOOL LAND AREA OCCUPIED BY BUILDINGS IS

- 1) 6–8%
- 2) 10–12%
- 3) 15–18%

7. SCHOOL BUILDING, LOCATED ON THE LAND AREA, SHOULD BE REMOTE FROM THE RED LINE BY NO LESS THAN

- 1) 25 meters
- 2) 50 meters
- 3) 100 meters

8. STUDY-EXPERIMENTAL ZONE, LOCATED ON THE SCHOOL LAND AREA, SHOULD OCCUPY NO MORE THAN

- 1) 25%
- 2) 35%
- 3) 55%

9. ECONOMIC ZONE SHOULD BE PLACED FROM THE SCHOOL BUILDING AT THE DISTANCE OF NO LESS THAN

- 1) 35 meters
- 2) 50 meters
- 3) 10 meters

10. SCHOOL DOCTOR'S OFFICE SHOULD HAVE THE LENGTH AT LEAST

- 1) 4 meters
- 2) 6 meters
- 3) 7 meters

SITUATIONAL PROBLEM

The secondary educational school No. 1 of the city N, designed for 464 pupils, is located on the territory of a micro district on a quarterly basis at a distance of 50 m from inter block roadways. On the windward side 100 m from the school there is an industrial enterprise of the 2nd danger class. The land plot is rectangular; the total area is 2 hectares. The following areas are identified on the site: the physical culture and sports, studying-experimental, recreational and the economic courtyard with a separate entrance from the street. The area of greenery is 12000 m².

Assess the presented plan of the school section for compliance with sanitary and hygienic requirements.

4. HYGIENIC EVALUATION OF SCHOOL FURNITURE, TUTORIALS AND CHILDREN'S TOYS

Purpose of the lesson is to familiarize students with hygienic requirements for school furniture, teaching aids, children's toys.

Physiological and hygienic basis for correct body position during various types of activity. The main working position of a student's body during classes is sitting, which is the most favorable position in comparison with the standing one, in terms of energy costs. It is also characterized by a larger area of support, a lower location of the center of gravity and, accordingly, a more stable state of equilibrium of the body and hemodynamics. However, a sitting posture is accompanied by a static tension of the muscles of the back, neck, abdomen, upper and lower extremities. Preservation of the posture is due to physiological tremor – constant minor movements in relation to the middle position and is regulated by the neuromuscular system and the joint apparatus. The main task of maintaining the posture is to minimize the magnitude of deviation of the center of gravity from the equilibrium position. This is the most difficult in the younger school age due to the peculiarities of the central nervous system (predominance of excitation processes) and the imperfection of bone marrow apparatus. The reason for the displacement of the center of gravity when sitting is increase in the inclination of the trunk and head in anterior direction.

From the hygienic point of view, sitting poses with a small slope of the body and head, which are defined as a straight sitting, are optimal (Tab. 19, Fig. 11). Such sitting pose is the least tiring for reading and writing, since the center of the body gravity, usually located between the bodies of IX and X thoracic vertebrae, is directly above the plane formed by the support areas, specifically the sciatic tubercles and the iliac bones. The line of the center of gravity is approximately vertical behind the coxofemoral joint. The distance from the pupil's eyes to the book is equal to the length of the forearm and the hand with extended fingers.

The shoulder belt retains a horizontal position, the forearm and hands are symmetrically located on the surface of the table, the trunk is moved 3–5 cm from the edge of the table, the back rests on the back of the chair or bench at the level of the waist.

Goniometric indicators of optimal posture when the schoolchild is planted

Indicator	Angle, degrees
Head inclination	26–51
Angle of flexion of thoracic spinal segment	41–62
Body tilt	85–100
Popliteal angle	75–105
Ankle angle	75–105
The angle of inclination of thoracic part of the body in relation to the lumbar	170–160

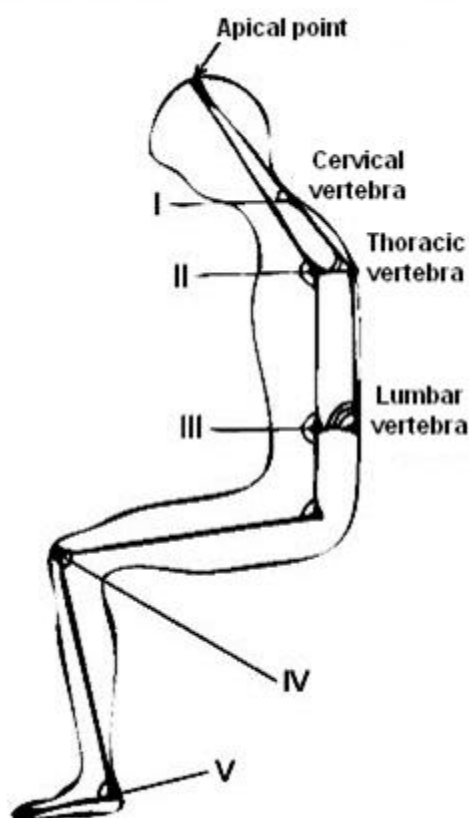


Figure 11. Bending angles of a student's body during classes: I – is the angle of head inclination; II – the angle of the spinal thoracic region flexion; III – the angle of the body; IV – the knee angle; V – the ankle angle

The hips are bent at right angles to the body, at least $\frac{2}{3}$ and not more than $\frac{3}{4}$ of their length is located on the seat, which prevents compression of the neurovascular bundle in the popliteal fossa. The feet of the student leans against the floor (with the legs bent at the knee angle of $75\text{--}105^\circ$) or on the running board.

When a schoolchild is properly sitting, there is a sufficient amount of support areas (seat, bench back, floor or table foot, table surface), which reduces muscle tension and possibility of premature fatigue. Such posing provides a stable balance with minimal muscle tension and normal activity of the thoracic and abdominal cavities, as well as the visual analyzer.

With a greater deviation of the trunk forward from its direct position, the center of gravity also moves anteriorly and it becomes more difficult for the muscles to keep it from a further falling. The head of the schoolboy sitting this way is lowered, his eyes are close to the notebook, which lies on the desk, the organs of the thoracic and abdominal cavities are squeezed, the support in the lumbar part of the spine collapses, and thus the student is forced to rely additionally on hands and chest on the table top. With this position of the trunk, the learning work is difficult to perform, the tension of the pose supporting muscles increases, the posture becomes unstable, muscle tension asymmetry arises, which causes postural disorders. The pupil has a faster pulse, the amplitude of respiratory movements gets down, there are pathological phenomena associated with venous stasis in the limbs and small pelvis, and frontal sections of the intervertebral discs are squeezed. Improper sitting pose causes rapid fatigue, decreased attention and performance. In addition, it is a factor contributing to the development and progression of myopia due to a violation of the optimal distance from the book to the eyes.

Hygienic requirements for school furniture. Hygienic requirements for school furniture are based on the modern data on anthropometry, physiology, ergonomics and contribute to harmonious development of children, development of their correct posture, long-term preservation of working capacity, prevention of visual analyzer and musculoskeletal system impairments. The most important requirement for school furniture is the obligatory *correspondence of its size and design to the anatomical and physiological capabilities* of pupils' body, height and body proportions, in order to provide conditions for its convenient, correct position during classes, called "pose". It is known that many diseases, including cardi-

ovascular, neuropsychiatric, diseases of the digestive, musculoskeletal system and others, are formed in childhood. According to the official state statistics, at the end of the school education the healthy are 10–20% of all children, whereas in 50–60% of the children postural disorders are prevalent, and also myopia is progressing. The main cause of these diseases is neglect of hygiene norms and rules in the process of education and training of children and adolescents. The main educational furniture in schools now is represented by tables and chairs. Withdrawal from the production of the classical Erismann pupil desks led to a significant increase in the number of musculoskeletal system diseases in schoolchildren.

Correct sitting is possible only if the individual parts of the table and chair (desks) are aligned with the growth and size of the student's body.

Chair seat. The height of the seat should correspond to the length of the shin with the foot plus 1.5–2 cm to the height of the heel, with the feet entirely resting on the stand or the floor. At a greater height of the chair, the pupil's legs will hang, the area of the support will decrease, and the muscle load on the hips will increase. With a lower height, the legs will rise above the chair, forming an acute angle between the shin and thighs, which will impede blood circulation in the legs and reduce the footing area. The depth (anterior-posterior size) of the seat should be approximately $\frac{3}{4}$ of the length of the thigh. The seat should be slightly tilted backwards to prevent the student from sliding forward.

Back of the chair. The contour of the chair back (desk) should correspond to the physiological bends of the spine in the lumbar and thoracic parts. The best is the backrest, consisting of 2 horizontal bars. The lower bar serves to support the lumbar spine. If this support for the back is excessively low, it comes into contact with the sacrum, which makes it difficult to sit comfortably and causes slipping forward. The upper backboard serves to support the lower thoracic part of the spine and is used at a time when the student listens to the teacher. It is forbidden to use stools and benches instead.

The cover of the desk consists of horizontal and inclined parts. Written accessories are placed on the horizontal part, and the inclined part serves for the execution of written works. The inclined position of the desk cover (inclination angle $7\text{--}15^\circ$) facilitates accommodative work of the eyes, since the distance from the eyes to any line of the book is almost the

same and the degree of accommodation of the eyes during reading will be constant.

The distance of 8–9 years old schoolboy's head from the text on the music stand, on average, should be 24.2 cm; at the age of 11–12 years – 29.1 cm; at a more advanced age, the distance from the book during reading reaches 30–35 cm.

Very important in terms of hygiene is the relationship between the seat and the table, defined as the differentiation, the distance of the backrest and the distance of the seat; at the desk these values are fixed.

Differential is the distance (vertically) from the edge of the table, facing the student, to the seat. It should be equal to the distance from the surface of the seat to the elbow of a person's free hand sitting with the addition of 3–6 cm, which gives a favorable ratio of the body angles. If the differential is too high (high table or low seat), the shoulder girdle is lifted, especially the right shoulder (right-sided scoliosis develops), the distance from the eyes to the working surface may be 8–10 cm. Underestimation (low table or high seat) which can lead to stooped, curved spine (kyphosis), compression of the thoracic and abdominal cavities; the normal distance from the eyes to the book (copybook) is also violated.

Backrest distance – the distance (horizontally) from the edge of the table top facing the student to the back of the seat. It should not exceed the anterior-posterior size of the child's body by more than 5 cm. At a great distance, the distance from the eye to the book or notebook increases, which requires an involuntary torso tilt. At a smaller distance, the child is clamped between the edge of the table and the back of the chair, which makes it difficult to move the chest.

The distance to the seat is the distance from the edge of the table facing the student to the front edge of the seat horizontally. It can be negative, positive and zero. If the distance is negative, the seat should go over the edge of the table. At zero distance, the edge of the table and chair are located on the same vertical. With a positive distance, the vertical line runs ahead of the edge of the bench. Positive distance is necessary for the student when answering from the place, when sitting down at the desk and at the exit because of it. It is created by the presence of a folding table top. When writing and reading the negative distance of the seat is most favorable, zero is permissible and the positive is inadmissible.

Dimensions of school furniture. The current state standards for school furniture (GOST 11015-93, SanPiN 2.4.2.2821-10) regulate production of 6 sizes of school furniture, with color markings (Tab. 20). It is established that the main sizes of the school furniture can be the same for students, who differ in height by no more than 15 cm.

Educational furniture has a factory marking, according to which it can be correctly selected for each student (Tab. 20). Marking is applied to both sides of the table (desks) and seats in the form of a circle with a diameter of 22 mm or a horizontal strip 20 mm wide.

Table 20

Functional dimensions of school furniture, color of marking according to account the child's height

Furniture number	Height group, mm	Height above the floor of the table top facing the student, mm	Color of marking	Height above the floor of the front edge of the seat, mm
1	1000–1150	460	Orange	260
2	1150–1300	520	Purple	300
3	1300–1450	580	Yellow	340
4	1450–1600	640	Red	380
5	1600–1750	700	Green	420
6	More than 1750	760	Blue	460

Materials for furniture production. The table top (desks) and seat with the backrest should be made of materials with low thermal conductivity (usually wood, plastic). The working surface of the school desk should be flat, clean, without hairiness. School furniture should allow it to be washed with warm (60°C) water using detergents and disinfectants, and its use should not be accompanied by noise or creaking, distracting children's attention.

Color of furniture. For the prevention of visual fatigue furniture coloring should be sufficiently light (the most desirable is the green range of colors and the color of natural wood), and necessarily matte (to prevent glare, it is inadmissible to cover the sides with shiny lacquers).

Selection of furniture. The proportions of the body vary depending on its length, so the leading factor in determining the group of the furniture is body height. In the hall (or in the classrooms) of the school it is recommended to hang out a color measuring ruler, on which color strips are respectively applied to the groups of furniture. On this line, students can independently measure its height and determine the marking color of the desired group of furniture (according to Tab. 20).

Hygienic requirements for the placement of school furniture in classrooms and the seating scheme of the students. For a correct seating of students at the beginning of academic year, a scheme with the name, height, vision, hearing, posture of each student and the required group of furniture is filled. This scheme should be kept in the gradebook.

Typically, classrooms are equipped with furniture of 2–3 size groups; for the initial school classes, the furniture of size 1, 2 and 3 is needed. Next to the blackboard the smallest size furniture is placed, then of increasing sizes, with a passage between desk lines of at least 0.6 m and from the walls to the lateral desk lines of 0.5–0.7 m. If necessary to place furniture of larger sizes closer to the blackboard, it should be placed so only in the outermost desk line. For school children with decreased visual acuity the working places are allocated in favorable conditions with respect to natural illumination – at the first or second desk (table) located in the place near the window. Provided with sufficient correction of visual acuity with glasses (contact lenses), students can sit at any place. Pupils with reduced acuity of hearing (perception of spoken speech at a distance of 2 to 4 m), should also be assigned to the first and second desks (tables) in any place. Schoolchildren with rheumatic diseases and also often-ill children (angina, acute respiratory diseases) must have a seat farther from the outer wall of the classroom.

In order to prevent violations of posture at least 2 times a year (better – once in four months) those schoolchildren sitting in a lateral desk line (next to window or to the opposite wall), exchange their places, without violating the correspondence of furniture numbers to their height.

It is very important to observe the distance from the first desks (tables) to the chalkboard. In rectangular classes (cabinets), this distance should be at least 2.4 m, and in the classroom of a square or transverse configuration – at least 3 m. The last desk row must be remote from the blackboard by no more than 8.6 m.

Requirements for the training blackboard. The angle of view of the board is the angle formed by a line running from the edge of the board 3 m long to the middle of the student's marginal seat behind the front table, and the line formed by the front rows of desks must be at least 35° for pupils of grades 5–9, for schoolchildren 1–4 grades – not less than 45° .

The height of the bottom edge of the training board above the floor should be 70–90 cm. The board must have a dark green or dark brown color and an anti-reflective coating. Physiological studies found that the highest level of visual performance of students when working with a black-and-green color board when writing text with bright yellow chalk: visibility is increased by 11%.

Classrooms should have trays to hold chalk, dust, chalk store, rag, holder for drawing accessories. When using the marker board, the marker color should be contrast (black, red, brown, dark tones of blue and green).

It is allowed to equip classrooms and offices with interactive whiteboards, touch screens, information panels and other means of displaying information that meet hygiene requirements. When using an interactive whiteboard and a projection screen, it is necessary to ensure its uniform illumination and the absence of high-brightness spots.

Hygienic requirements for schoolbooks. At school age, reading is the main type of educational activity affecting intensity of the general mental load of children, so hygienic recommendations for teaching aids are given in order to create the most favorable conditions for visual work, taking into account the gradual formation of reading skills in children of different ages. These requirements are legally enshrined in SanPiN 2.4.7.1166-02 "Hygienic requirements for educational publications for general and primary vocational education".

Hygienic characteristics of a schoolbook is based on evaluation of the font, set, print, quality of paper and illustrations, its appearance and weight.

Exterior design of books. Hygienic requirements to the format and binding of books provide for the convenience of using them, the strength and the reduction of the possibility of transmission of infections; they also include the requirements of decoration and pedagogy. Preferred are small formats that make it easy to hold a book in your hand. Mandatory is a hard binding of a durable material that is minimally contaminated. For binding, we recommend materials on a paper or fabric basis using approved syn-

thetic and polymer coatings. It is not allowed to apply the methods of fixing the publication unit, leading to deterioration in reading conditions, for example, adhesive binding.

The maximum weight of a book is regulated: for 1–4 grades – no more than 300 g; for grades 5–6 – 400 g; for 7–9 grades – 500 g, for 10–11 grades – 600 g. It is allowed to increase the mass of the book by no more than 10%. The weight of a daily set of schoolbooks and writing materials should not exceed: for students in the 1–2 classes – 1.5 kg, 3–4 classes – 2 kg, 5–6 classes – 2.5 kg, 7–8 classes – 3.5 kg, 9–11 classes – 4.0 kg. The weight of a knapsack without textbooks for students of grades 1–4 is not more than 700 g. In order to prevent violations of the posture of students for primary classes it is recommended to have two sets of the same textbooks: one set is for use during classes, the second – for preparation of the homework.

Paper for textbooks should be strong, white or slightly yellowish, opaque (completely invisible print on the reverse side), clean and smooth (no roughness and irregularities in the form of hairs, spots), uniform dressing (no "cloudiness" when viewed through transmitted light); paper should not be glossy. Do not use newsprint paper.

The font, its size and pattern should correspond to the age-specific features of visual perception and degree of reading skills development. From the hygienic point of view, the greatest importance is the size of all elements of the letter and their ratio (Tab. 21). When publishing textbooks it is recommended to use fonts with a simple clear lettering and clear intra-letter spaces. For the 1st class, it is recommended that the alphabetic head-set, the alphabet and the journal headset be chopped, of direct shape. For the 2nd class – a log chopped and school set. For middle and senior classes you can use a literary headset. The words and phrases highlighted in the text are recommended to be typed in bold (italics are allowed).

The printing of school textbooks should be clear, intense, black and uniform. Similar elements of headings, formulas, tables, rules, conclusions, signatures to illustrations, individual words-terms should be uniform throughout the entire edition. Color printing can be used: a colored font on a white background, a black font on a colored background (light blue, light green, yellow, orange), and white text on a red dice. Small font (petit) is allowed to use only when typing pointers, dictionaries, lists of literature. In textbooks for the senior grades (8–11), it's possible to type with the petit of questions, assignments, sub-paragraphs in the table of contents.

Basic font sizes for typeset of schoolbooks

Tutorials by parts and grades	Height of lowercase letter "H", mm	Thickness of the main (vertical) strokes, mm	Thickness of connective strokes (horizontal and sloped), mm
New letters of the preparatory part of the primer	8.0–6.0	1.5	1.2
The literal part of the primer	4.5–4.0–3.5	0.5	0.5
After-letter part of the primer, textbooks for the 1st grade	2.8	0.5	0.45
Textbooks for the 2nd grade	2.8	0.3	0.15
Textbooks for the 3rd and 4th grades	2.3–2.0	0.3	0.15
Textbooks for grades 5–7	1.75	0.25	0.15
Textbooks for grades 8–11	1.75–1.70	0.25	0.15

Typesetting. The typesetting of books is understood as the height of pages, the length of lines, the distance between lines (leading), between letters and words, the number of signs on an area of 1 cm^2 , the width of fields (Tab. 22). In the editions for 1–4 grades, a question between words is not less than the size of the text font; for grades 5–11 it's at least half the size of the text font.

The density of the set, that is, the number of characters per cm^2 , determines the quality of the set as a whole. The number of visible lines should not be more than 2, the number of characters in the textbooks for 1st and 2nd grade pupils – no more than 10, and in the textbooks for 5–11 th grades – no more than 15 characters. The use of a two-column set in textbooks is undesirable, since it increases the frequency of eye movement from line to line, making it difficult to find the beginning of lines. It is allowed in dictionaries and reference books. Two-column set of poems is allowed only if the distance between the columns is not less than 18 mm. The fields facilitate reading, creating a contrasting background with printed characters. At the same time, they are an element of the design of the book, giving it a neat appearance. Fields, not including the illustrative filling of fields, should be at least 10 mm.

Recommendations for a typesetting for schoolbooks

Textbooks by grades	String length, mm	Leading (between strings distance), mm	Between words space, mm	Interletter space, mm
For the 1st and 2nd grades	$\geq 126-130$	2.8	$\geq 4-11$	0.5
For the 3rd and 4th grades	120-130	2.8	3	0.5
For grades 5-9	90-120	≥ 2.7	2	0.5
For the 10-11th grades	90-105 two-column set	≥ 2.7	2	0.5

Hygienic requirements for children's toys. With the help of toys and games, a child learns the world around him/her. At the same time, visual and auditory perceptions, voice reactions, speech, motor skills, the ability of independent movement, thinking, etc., make for the child's physical and mental development.

Currently, saturation of the market with children's toys, the quality of which is often a danger to the physical and mental health of children, is the matter of concern.

At the 1st year of life, toys should develop visual and auditory perception, voice responses, movements that allow the body to change its position (sit down, get up, cling to the barrier). The most common are toys made of polymer materials – rattles, rings. They should be large enough, easy to grasp, have a bright color, and make a sound.

At the 2nd year of life dolls, animals, cars, wheelchairs can be used for the game.

In the following years the child learns the world more actively, his/her speech develops, the movements improve. In this age period, more diverse and complex toys are used: pyramids, cubes, mosaics, building material.

In accordance with the morphologic and functional features of children, by development of cognitive and intellectual abilities the games and toys are divided into 5 groups:

- for children of early age – up to 1 year;
- for toddlers 1–3 years; for children of preschool age – 3–6 years;
- for children of primary school age – 6–10 years;
- for children of secondary school age – 10–14 years.

Children's toys should correspond to their functional purpose, taking into account the age characteristics of children, and certain aesthetic and hygienic requirements set forth in the current federal sanitary rules and norms "Production and sale of games and toys" (SanPiN 2.4.7.007-93). Their safety must be confirmed by a certificate of compliance (quality).

For production of toys (games), it is permitted to use raw materials and materials that have been hygienically evaluated and confirmed by an appropriate conclusion. These materials should not include poisonous, harmful substances for the body. Wood, metal, fabric, cardboard, plastic are used only as new ones (whole or as industrial waste).

It is not allowed for the production of toys to use scrap, natural fur and leather (for toys intended for children under 3 years old), woody bark; rubber, cardboard and paper nap (for children under 3 years old).

Details of musical wind toys intended for contact with children's lips, rattles should be made from easily disinfected materials that do not absorb moisture.

According to the form, the toys must be comfortable and safe. There are no burrs, cracks, chips on the surface of toys. Sharp edges and corners of parts must be blunted or hidden.

Toy parts for children under 3 years old, made of metal, wood or other hard materials, must be fixed in the toy in such a way that they cannot be detached or torn.

The stuffing materials must not contain solid or sharp foreign bodies (metal shavings, nails, wood chips, glass, plastic fragments, etc.). Packing elements that are smaller than or equal to 3 mm in size must be contained in the inner case. Fillers for rattles should have a diameter of at least 5 mm.

Collapsible toy designs for children under 3 years (pyramids, sets of rings, balls on the rod, etc.) should not have details less than 32 mm in diameter.

The tips of parts of throwing toys ("Riffle", "Pistol", "Bow") and others must be protected by soft rubber or suckers, the diameter of which

should be at least 20 mm. Toys that mimic a cold weapon (a sword, a knife, etc.), should not have sharp ends and cutting edges.

The coloring or protective coating of toys should be resistant to saliva, sweat and wet handling, including disinfection (excluding soft toys). Surface staining and painting of rattles is not allowed.

The weight of the toy must correspond to the strength of the child: for preschool children should not exceed 400 g, for younger schoolchildren – 800 g. The mass of toys like rattles should not be more than 100 g.

The level of smell of toys or parts made of rubber and polymeric materials for children under the age of 1 year must be no more than 1 point, for children over the 1 year age – no more than 2 points (Tab. 23).

Table 23

Determination of odor intensity

Intensity of odor, score	Characteristic intensity	Description of the nature and manifestations of odor
0	No smell	Lack of tangible smell
1	Very weak	The smell, usually not noticed, but detected by an experienced taster
2	Weak	The smell detected by an inexperienced taster, if you pay attention to it
3	Perceptible	Smell, easily noticed and likely to cause disapproval
4	Distinct	Smell, attracting attention, causing negative feedback
5	Very strong	The smell is so strong that it causes unpleasant sensations

The sound level produced by a toy intended for indoor use (excluding musical instruments) should not exceed 65 dBA, and the sound level produced by a toy intended for playing outdoors is not more than 75 dBA. The sound level of a toy that emits impulse noise (single shot) should be no more than 95 dBA.

To prevent electric trauma due to the toys having microelectric motors, the electrical voltage should not exceed 12V for younger children and 18V for schoolchildren.

Large inflatable toys intended for playing on water must have non-return valves and at least 2 insulated air chambers.

Prevention of injuries and protection of children's health is promoted by the requirements to the strength of attachment of individual toy parts. All parts must not be torn off at an effort of 10 kg.

PRACTICAL PART

1. Conduct hygienic study of school furniture (Erisman's desks) according to the scheme:

- measure the height of the seat and the desk top of Erisman's desk;
- using table 20, determine the number of the desk, the color marking;
- determine the distance from the seat, its color, the color of the desk and lid, its sanitary and technical condition;
- give hygienic assessment, draw a conclusion as to for children of which height the desk can be used.

2. Determine the required number of a desk for a boy having height of 154 cm.

3. Conduct hygienic study of the school textbook according to the scheme:

- name of the textbook,
- author, publisher, place and year of publication,
- for which class is the textbook intended,
- weight of the textbook,
- material and color of the cover, binding,
- paper: color, shade, surface quality, gloss, translucency;
- print quality: color, color intensity, uniformity, clarity;
- font: the height of the letter, the thickness of the letter of the main and additional (measurements are made in the lowercase letter "H" not less than three pages at the beginning, middle and end of the book).
- typeset: length of the full line, distance between strings, distance between words, the density of the typeset. To measure the density of the typeset, use the Kohn plate, which is a surface with five square cut holes (1 cm²). When determining, the upper edge of the top square is superimposed

on the upper edge of the line, the counting of the signs is made in all five squares, then determine the average.

- width of fields;

- formulate a conclusion about the compliance of the textbook with hygienic requirements.

4. Conduct hygienic research of children's toys according to the scheme:

- name of the toy, its brief description;

- size of the toy;

- shape of the toy (the presence of sharp corners, edges, small and easily detachable parts);

- strength, weight of the toy;

- materials from which the toy is made;

- strength of dye fixation*;

- condition of the toy as to contamination;

- make a conclusion about the conformity of the quality of the toy to hygienic requirements, give recommendations on the possibility of using the toys by children of this or that age group (see page 67).

**Determination of the strength of fixing paints:*

1. The sample of the toy is washed with hot water (60°C) with soap for at least 3 minutes, and then the condition of the paints is determined.

2. The sample of the toy is exposed for 2 minutes with a 1% solution of HCl, KOH, NaHCO₃.

An unsatisfactory fixation of the paint is judged by the change of the color of a white cotton swab at contact with the surface of the toy, as well as the change in the surface of the toy (tarnishing color, sticky toy surface, etc.).

QUESTIONS FOR SELF-CONTROL

1. Hygienic justification of the correct posture of sitting for pupils during the lesson.

2. Hygienic requirements for school furniture: the material from which furniture is made; coloring; height and depth of the seat; the contour of the back; the inclination angle of the table top; differentiation; backrest distance, seat distance.

3. Marking school furniture.

4. Rules for arranging furniture in the classroom and seating of the students.
5. Hygienic requirements for the chalkboard (material, color, installation height of the bottom edge of the board).
6. Hygienic requirements for school textbooks: appearance, mass, quality of paper, font, print, set of books.
7. Hygienic requirements for children's toys: material for making toys, weight, shape and design, color, level of smell and sound, electrical safety.

SITUATIONAL PROBLEM

Rattle "Bright Bird" for children of toddler age has a smooth surface, with protruding, non-sharp angles, without small details. The weight of the toy is 65 g, the holder ring having diameter of 35 mm is filled with balls with a diameter of 5 mm. The level of the smell of the rattle is 2 points (determined by an inexperienced taster), fixing the color of the coating is strong (when exposed to 2% KOH solution for 1 minute).

Give hygienic conclusion about the toy.

ANSWERS TO THE TEST TASKS

LESSON 1		LESSON 2		LESSON 3	
Task number	Answer number	Task number	Answer number	Task number	Answer number
1	1	1	1	1	1
2	3	2	4	2	2
3	1	3	1	3	1
4	3	4	2	4	3
5	4	5	1	5	4
6	2	6	1	6	2
7	2			7	1
8	3			8	1
9	1			9	1
10	4			10	3

ANSWERS TO SITUATIONAL PROBLEMS

LESSON 1

Problem 1

Passport age of the child is 10 years. Further, using the regional standards (Tab. 4), we will compile the table:

Indicator	Individual value given (A)	Age and sex-specific average value (standard)		Absolute deviation from the average	Signal deviation
		M	σ		
Height (cm)	138.4	136.6	5.6	+1.8	+0.3 σ
Body weight (kg)	36.4	31.4	3.6	+5.0	+1.4 σ
Chest circumference (cm)	68.8	66.6	3.2	+2.2	+0.7 σ

For each indicator, calculate the magnitude of the sigma deviation by the formula:

$$(A - M) / \sigma$$

For the height: $(138.4 - 136.6) / 5.6 = +0.3 \sigma$

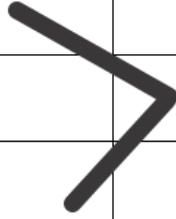
For the body weight: $(36.4 - 31.4) / 3.6 = +1.4 \sigma$

For the chest circumference: $(68,8 - 66,6) / 3,2 = +0,7 \sigma$

Consequently, the height is considered to be average, the weight is above the average, the chest circumference is within the average limits.

Then we draw the physical development profile:

	M-2 σ	M-1 σ	M	M+1 σ	M+2 σ
Height					
Weight					
Chest circumference					



Conclusion: the physical development is average, yet disharmonious. Perhaps, there is an unbalanced diet and a lack of motor activity.

Problem 2

According to Table 7 ("Indicators of biological development of children and adolescents") we find that the level of biological development lags behind the passport age and fits 11 years old in terms of height, development of secondary sex characteristics and the number of permanent teeth.

Problem 3

When determining the passport age of a child, the age grouping rules should be taken into account. Children from 3 to 7 years are grouped together with an interval of 6 months. Accordingly, a 5 years old child fits the range from 4 years 10 months 16 days to 5 years 2 months 29 days. Thus, the age group of the child at the time of the survey is "5-years group".

LESSON 2

The problem

The structure of the pre-school educational organization is located in violation of the existing sanitary norms and rules: the plot has an angular, rather than an intra-quarter location, the width of the sanitary protection zone from the industrial enterprise is 150 m instead of 300 m as should be by the standards; sufficient greenery area is not observed (33% instead of 50% of the plot area).

LESSON 3

The problem

The best option is to place the school on the territory of the micro district inside the district area, but in this case the distance from the roadway does not meet the sanitary requirements. In addition, the size of the sanitary protection zone should be at least 500 m.

The size of the land plot, its configuration corresponds to hygienic requirements. On the land there are all the necessary functional areas, more than 50% of the area is landscaped.

LESSON 4

The problem

According to hygienic requirements, the mass of the toy for toddlers must not be more than 100 grams; diameter of the ring must not be less than 30–32 mm, filler is to be with a diameter of at least 5 mm. The odor level of toys for children under 1 year of age should not exceed 1 point (very weak, determined by an experienced taster). Fixation of color is satisfactory, as withstands the treatment with 1% KOH solution for 2 minutes.

Thus, this toy for toddlers does not meet the hygienic standards for the odor level.

RECOMMENDED READING

1. Arkhangel'sky V.I. et al. Hygiene with the basics of human ecology: textbook [Electronic resource] / ed. P.I. Melnichenko. – M.: GEOTAR-Media, 2013. – 752 p.
2. Arkhangel'sky V.I., Kirillov V.F. Hygiene and human ecology: textbook [Electronic resource]. – M.: GEOTAR-Media, 2013. – 176 p.
3. Arkhangel'sky V.I. Hygiene and human ecology [Electronic resource]. – M.: GEOTAR-Media, 2014. – 176 p.
4. Hygiene of children and adolescents. A guide to practical studies: textbook / ed. V.R. Kuchma [Electronic resource]. – M.: GEOTAR-Media, 2012. – 560 p.
5. Kuchma V.R. Hygiene of children and adolescents: textbook [Electronic resource]. – 2nd ed., rev. and add. – M.: GEOTAR-Media, 2015. – 528 p.
6. SanPiN 2.4.1.3049-13. "Sanitary and epidemiological requirements for arrangement, content and organization of operating of pre-school educational organizations" (as amended by the Decrees of the Chief State Sanitary Doctor of the Russian Federation No. 28 of July 20, 2015, No. 41 dated August 27, 2015, as amended by the Decision of the Supreme Court of the Russian Federation of 04.04. 2014 N AKPI14-281).
7. SanPiN 2.4.2. 2821-10. "Sanitary and epidemiological requirements for conditions and organization of training in general education organizations" (in the edition of Amendments No. 1, approved by the Resolution of the Chief State Sanitary Doctor of the Russian Federation No. 85 of 29.06.2011, Amendments No. 2, approved by the Resolution of the Chief State Sanitary Doctor of the Russian Federation of December 25, 2013 No. 72, Amendments No. 3 approved by the Resolution of the Chief State Sanitary Doctor of the Russian Federation No. 81 of November 24, 2015).
8. SP 118.13330.2012 "Public buildings and facilities." Updated version of SNIp 31-06-2009 (with Amendment No. 1).
9. Order of the Ministry of Health and Social Protection of the Russian Federation of 14.03.1995 № 60 "On approval of the Instruction for conducting preventive examinations of children of preschool and school age on the basis of medical and economic standards."
10. Order of the Ministry of Health of the Russian Federation of 30.12.2003 № 621 "On the comprehensive assessment of the health of children."
11. SanPiN 2.4.7.1166-02.2.4.7. "Hygiene of children and adolescents. Hygienic requirements for educational publications for general and primary vocational education "(as amended by the Resolution of the Chief State Sanitary Doctor of the Russian Federation No. 78 of 02.12.2014).

12. SanPiN 2.4.7.007-93. "Production and sale of games and toys. Sanitary rules and norms "(as amended on 19.12.2005, as amended on 28.10.2010).
13. MUK 4.1 / 4.3.2038-05. «Control methods. Chemical factors / physical factors. Sanitary and epidemiological evaluation of toys. Guidelines».
14. Training Course on Child Growth Assessment: WHO Child Growth Standards [Electronic resource] / World Health Organization. 2008. Access mode: https://www.who.int/childgrowth/training/jobaid_weighing_measuring.pdf.

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