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Some Aspects of Teaching Physics at School

Key words: *systematization of physical phenomena, objects of systematization, non-standard laboratory work.*

Annotation: *in this article has been studied the place and role of systematization of physical phenomena, using of non-standard laboratory work in the study process of studying the subject of physics in the educational process. It is shown that with such a combined use, the given teaching methods give the maximum result of mastering educational material of different categories.*

Studying physics, students get acquainted with a number of natural phenomena and their scientific explanation, they form a belief in the materiality of the world and in the unlimited possibilities of human knowledge of the surrounding world. An elementary course of physics, despite its elementary nature, should provide systematic knowledge and provide for students' initial acquaintance with physical theories, i.e. It is presented taking into account modern ideas about the molecular-kinetic theory of the structure of matter, the structure of the atom and the electronic theory of matter.

At present, this is of particular importance in connection with the task of further raising the scientific level of teaching the fundamentals of science in school, enhancing the role of instruction in the development of pupils' thinking in shaping their scientific world view. AV. Usova pays special attention to the following tasks of teaching physics in high school (1):

• communication to students of initial knowledge in physics (on mechanical motion, molecular, thermal, electrical, and optics);
• familiarization with the methods of using the simplest devices, performing non-standard laboratory measurements, setting experiments, analyzing the conclusions based on these experiments;
• independent work with a textbook and solving basic problems;
• application of knowledge to explain the phenomena observed in the nature of the surrounding life;
• implementation of polytechnic education of students and free choice of profession.

Systematization allows you to more effectively influence students, as well as streamlines knowledge and at the same time serves as a source of new knowledge. Possible objects of grouping, systematization in the course of physics are the structural forms of matter, the properties of the bodies of "particles", phenomena, processes, types of motion, devices, machines, installations, and research methods. The establishment of causal relationships and relationships between the studied facts, the selection of the main features, the consideration of a particular object as part of the whole system is also subject to systematization. This goal is served by the selection of the main components of the internal energy of the body, the knowledge of which students receive in various sections of the physics course.

The object of systematization can also be the quantities characterizing the properties of bodies and phenomena, formulas expressing the relationship between them. Sometimes they are given in the form of a system of equations arranged in a certain sequence. In the works of AV Usov, these problems were investigated to some extent (1, 2). To systematize and summarize students' knowledge, we present and recommend classification tables, for example, the kinematic equation can be presented in the form of table 1.

Since physics is taught in high school in the final lesson, for example, on the topic “Electric field”, students can be compared to compare the basic properties of the electric and gravitational fields.

Table 1

№	Modes of movement	Values characterizing movements and formulas expressing the relationship between quantities				
		Speed	Acceleration	Moving	Coordinate	move-s way-l
1	Uniform rectilinear	$v = \frac{S}{t}\ (\frac{м}{c})$	$a = 0$	$S = vt\,(m)$	$x = x(t)$ $x = x_0 + vt$	$S=l$
2	Equal from dormancy	$v_{cp} = \frac{S}{t};$ $v = at$	$a = \frac{v_u}{t};$ $v_0 = 0$	$S = \frac{at^2}{2};$ $v_0 = 0$	$x = x_0 + \frac{at^2}{2}$	$S = 0, l > 0$ *или* $l > S$
3	Equal with initial speed, $v \neq 0$	$v = v_0 + at$	$a = \frac{v_1 - v_0}{t}$	$S = v_0 t \pm \frac{at^2}{2}$	$x = x_0 + v_0 t \frac{at^2}{2}$	$S = 0, или$ $l > S$
4	Body cast vertically upwards	$v = v_0 - gt$	$a = g$	$h = v_0 t - \frac{gt^2}{2}$	--	$\ell \geq S$
5	Drop body vertically down	$v = v_0 + gt$	$a = g$	$h = v_0 t + \frac{gt^2}{2}$	--	$\ell \geq S$

Performing this comparison, high school students should complete the table (Table 2). Such a system for memorizing material is intentional and is designed for long-term preservation in memory. Also for comparison the type of classification can be used. Under the classification

understand the distribution of objects or objects into groups based on any essential feature. The classification table is, in particular the table, the structural forms of the substance (Table 3).

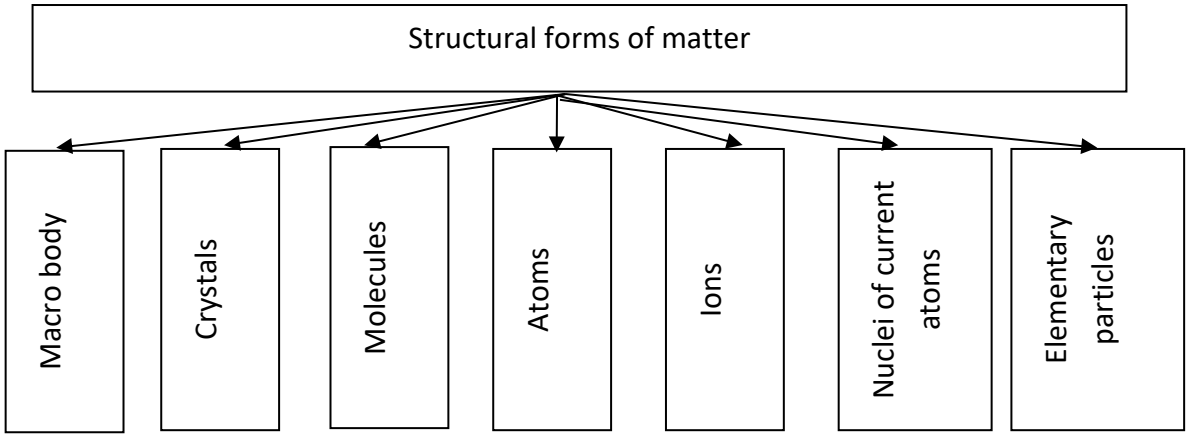
Table 2.

№	Main characteristics	Field view	
		Gravitational	Electrostatic
1	The interaction between which objects is carried out	Between all bodies (particles)	Between charged bodies (particles)
2	Interaction strength	$F = G\frac{m_1 m_2}{r^2}$	$F = k\frac{q_1 q_2}{r^2}$
3	Stress-field characteristic	$\vec{g} = \frac{\vec{F}}{m}$	$\vec{E} = \frac{\vec{F}}{q}$
4	Potential - energy characteristic of the field	The value determined by the ratio of the potential energy of the body at a given point in space to the body mass $\varphi = \frac{W_p}{m}$	The value determined by the ratio of the energy potential of the charge of a given field point to this charge $\varphi = \frac{W_p}{m} = Ed$
5	Potential difference (between two points)	$U = g(h_1 - h_2)$	$U = \varphi_1 - \varphi_2 = -\Delta\varphi = \frac{A}{q}$
6	Work	$A=mgh$	$A=qEd$
		not to depend on the shape of the trajectory along which the body moves	not to depend on the form of the trajectory along which the charge moves
		The work done by the forces of gravity when moving the body in a closed path is zero	The work of the electric field when the charge moves in a closed loop is zero
		$A = mg(h_1 - h_2)$	$A = -(W_{p_2} - W_{p_1}) =$ $= -q(\varphi_2 - \varphi_1) = -q\Delta\varphi$

Receiving classification using the above schemes is useful to systematize and summarize students' knowledge in order to better memorize in a physics course.

In connection with the problem of educating memory and the development of logical thinking and creative abilities among schoolchildren, the task is not only of applying systematization techniques to the teacher in the process of presenting new material, but also developing skills independently systematize the studied material, approach the already studied phenomena from a new point of view.

Table 3.



In connection with the problem of educating the memory and development of logical thinking and creative abilities among schoolchildren, the task is not only of applying systematization techniques to the teacher in the process of presenting new material, but also developing the ability of the students to systematize the studied material independently, to approach the phenomena already studied from a new point of view. In particular, to include previously acquired knowledge in the system of new concepts. Example, to operate with the concepts of kinematics in the study of dynamics, the concepts of kinematics and dynamics - in the study of electrostatics and electrodynamics.

Fostering students' interest in scientific knowledge and the development of research work abilities contribute to:
- raising the scientific level of teaching the subject, increasing attention to the study of physical theories, to explain physical phenomena, as well as the properties of bodies;
- familiarization of students with the methods used in scientific research in physics (experiment, analysis of experimental facts and conclusions from them, verification of conclusions in practice);
- the systematic inclusion of research elements in the educational process in physics, in various types of student learning activities, the implementation of a research approach to the study of specific topics and issues in the school physics course.

Laboratory work in teaching physics has a special educational and educational value. By conducting laboratory work, students are convinced of the objectivity of physical laws and get an idea of the methods used in scientific research in physics. The implementation of standard and non-standard laboratory work leads to deep learning by students of the physical laws, abilities and skills in handling measuring devices and the conscious application of knowledge in life.

The main place in the methodology of teaching physics at school is given to the introduction of students to the methods of scientific research, which is based on the performance of laboratory work. From the results of the analysis of work (1) and the generalization of practical experience, students develop abilities to perform non-standard laboratory work, which allows us to recommend the following ways to solve this problem in the process of teaching physics:

– carrying out practical work on the assembly, manufacture and design of devices; assembly of the device from finished parts in the classroom, for example, assembly of an electric bell and an electromagnetic telegraph;
– homework on the manufacture of devices, the study of devices and principles of operation of physical devices;
– familiarizing students with the work of rationalizers and inventors of the enterprise with which the school is associated, organizing meetings with them;
– familiarization with the problems of modern technology and the prospects for its development;
- attracting students to the improvement of school demonstration devices, as well as non-standard laboratory equipment;
- the development of students' design skills and technical installation.

Equally important are frontal laboratory work, including non-standard, which can be long, designed for an entire training session and short-term for 10-15 minutes. For example, short-term work can be, by definition, the density of a solid, spring gradation and force measurement with a dynamometer, voltage measurement in different parts of an electrical circuit. Frontal non-standard laboratory work can be performed at home, for example, a piece of butter in the morning in cold water is at the bottom of the vessel, and in the afternoon when the water becomes warm, a piece of butter moves to the upper part of the water. In the same vessel volume, two positions of oil can be observed. These experiments are explained by the laws of Archimedes and Pascal (3).

Thus, when organizing the learning process, the teacher must remember that in each lesson, with the addition of new knowledge to students, the formation of their skills and abilities, he must develop the logical thinking and memory of the students. To seek interest in the subject, the desire to independently acquire and deepen students' knowledge of physics, including using the above systematized knowledge and non-standard laboratory work.

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