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Formation of general education skills on molecular physics

Abstract: education has set a goal to develop personality traits that are needed for social and value activity of a person in society. It states that knowledge, ability, skills and competencies ensure the achievement of full development of all important qualities of the person. Including the demonstration of physical phenomena allows the teacher to direct the cognitive activity of students in the process of observation and study of phenomena in molecular physics. With the help of physical experiment solve different problems. Physics is an experimental science.

With the help of physical experiments, various tasks and learning goals are solved, we will consider the experiments of molecular physics. A number of possible ways for students to learn the laws that take into account the general characteristics of a particular gas and the strength of intermolecular interactions are analyzed. In addition, students study the difference between the van der Waals equation and the Mendeleev-Clapeyron law and make sure that this equation correctly describes the state of real gases.Therefore, the study of gas equations forms students' complex fundamental concepts, uses the distribution of interrelated levels of knowledge development, which are the most important conditions for their formation and assimilation.

The ordering of the basic ideas of molecular physics is of general importance for their mental development, especially for the development of imagination and theoretical thinking. In this regard, mastering the basics of scientific knowledge will undoubtedly contribute to improving the effectiveness of the educational process.

Keywords: physical experiment, molecularphysics, knowledge, ability, skills.

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Introduction. The content of education asserts a personality-oriented approach (I.J. Lerner, M.N. Skatkin, etc.), with the basic principles and criteria of modern general education, which are highlighted in the works of V.V.Kraevsky, I.Y.Lerner, V.A.Slastenin. This can be the observation of a problems of molecular physics, qualitative or quantitative study of the research method, introduction to the theory, confirmation of the conclusions of the theory, the application of physical laws in practice [1].

Principles of formation of the content of general education:

- the principle of conformity of the content of education in all its elements and at all levels of construction to the requirements of the development of society, science, culture and personality. According to this principle, the content of education includes the necessary knowledge, skills and abilities that reflect the level of development of knowledge, culture and personal growth;

- the principle of unity of content and procedural aspects of training. Education involves taking into account the pedagogical reality associated with the implementation of a specific educational process, outside of which the content of education can not exist;

- the principle of structural unity of the content of education assumes the consistency of the theoretical presentation, the subject matter, educational material, pedagogical activity and personality of the student;

- the principle of fundamentalization and humanization of the content of education [2].

Based on these principles, the subject "Physics", includes two blocks: content, which presents the main subject knowledge and non-subject knowledge, and procedural block, including methods of activity and forms of organization of the learning process.

Including a demonstration of experiments in molecular physics allows the teacher to direct the cognitive activity of students in the process of observation and study of physical phenomena. Physical experiments solve different problems. Educational and organizational skills in molecular physics provide planning, organization, conduct, regulation and analysis of students 'activities during classes (lectures, seminars, laboratory work and workshops). This can be the observation of a physical phenomenon, qualitative or quantitative study of the research method, introduction to the theory, confirmation of the conclusions of the theory, the application of physical laws in practice [3]. Knowledge of the device involves:

- knowledge of the name of the device and its main purpose, the principle of operation of the device and its main components;
- the ability to distinguish this device from others in appearance;
- knowledge of the technical capabilities of the device, its performance characteristics, permissible modes;
- the ability to use the device for its intended purpose and in combination with other devices, knowledge of the conditions that allow you to get the desired effect;
-the ability to perform simple repairs, replace individual parts, to adjust the device with deviations from the norm.

The ability to assemble a molecular physics installation reflects the degree of mastery of the demonstration experiment technique. It is essential to meet the requirements for demonstration experiments, and the rational use of means to ensure the effectiveness of the experience. The practice has developed certain rules for the Assembly of installations, which it is advisable to follow. They are reduced to the following:

- mental design of the installation, it is possible to draw a block diagram, block drawing of the location of devices, auxiliary drawing;
- selection of specific devices for this experience; Assembly position: the location on the sample table of the devices in a specific logical order, combining elements of the installation (normal installation is collected in an inclined or vertical plane; instruments, reflecting the significant experience should be in the foreground);
-check the feasibility of the requirements for the experiments, taking into account the possibilities of different media (in this case, you must make sure that the installation is clearly visible from every seat class);
- working out the sequence of operations that need to be performed when demonstrating the experience (working out the operations, you should consider the text that will accompany the experiment) [4].

Methods of research. To form key competencies in students activities using scientific research methods: -idealization (method of constructing idealized processes); - logical methods; -thought experiment; -methods of theory construction (from abstract to concrete, deductive);
- historical and other methods.

Results. The article considers the ability of students to demonstrate experiments for the formation of General education skills in molecular physics. Formation of skills by methods of applying visibility, demonstration.As well as the knowledge of the methods and techniques of conducting a demonstration experiment, the material covers various aspects of the educational process, including the activities of the teacher and the organization of studentscognitive interest.

The ability to demonstrate experiments, i.e. the possession of the methodology and technique of demonstration experiment, covers different aspects of the educational process, including the activities of the teacher and the organization of cognitive interest of students. In this case, the experiment can act in two aspects: in the deductive presentation of the material, it acts as a criterion of truth, confirms the conclusions of the theory, in the inductive approach is the main source of knowledge. In both cases, there is something in common: there should be nothing superfluous on the demonstration

table, i.e. there should be no devices, accessories, etc., that are not related to this experience; if the demonstration is accompanied by a drawing, pattern or scheme (which often happens), then we must relate the elements of the drawing with the devices and the details of the installation, and the layout elements must be placed so as to be arranged parts of the installation, the demonstration of the experiment the teacher needs to be behind the demonstration table (for devices); demonstrate experiments so that it does not obstruct the hands parts of the installation, it may be necessary to lift or rotate the demonstrated devices; the pace of presentation in the demonstration may vary relatively fast in the explanation of the installation and slower in the presentation of the essence of the phenomenon; do the pause when focus on the particular details of the installation on a particular component of the disclosed process; the results of the experience (perhaps part of the experience) make a clear and informed conclusion; the number of experiments is dictated by necessity as much as possible to discover the essence of the study; usually only two or three experiments [5].Knowledge of the methods and techniques of conducting a demonstration experiment forms the skills and cognitive interest of students.

Experience. Pressure inside the soap bubble

Equipment: soap solution, glass tee with two funnels and hose.

Dip one of the funnels of the tee into the soap solution and blow the soap bubble through the hose. The bubble has the shape of a sphere, since its area is the smallest among all other geometric shapes of equal volume.

Leaving the hose open, we observe a decrease in the volume of the bubble. This suggests that under the curved surface of the bubble pressure increased (more atmospheric).

Dip alternately both funnels in a soap solution and blow out two different sized bubbles, then squeeze the hose. We observe how the bubble of a small radius decreases, and the big one increases. This is because of the spherical soap film pressure.

$$P=2\,\alpha\,/R$$

where α - is the surface tension coefficient of the soap solution, R - is the radius of the bubble. Consequently, in a bubble with a large radius, the pressure is less than in a bubble with a smaller radius, and air flows from a small bubble to a large one.

Experience.Pressure gauge with heat receiver (the first beginning of thermodynamics)

Equipment: liquid U-shaped pressure gauge with heat sink, table lamp.

The thermodynamic approach to the study of molecular systems is that the state of a molecular system is determined through a change in its internal energy.

The first principle of thermodynamics States that the internal energy of a molecular system can be changed either in the process of doing work or in the process of heat transfer.

Take a liquid U-shaped pressure gauge, on one knee of which the heat receiver is fixed, and the other is open.

Cover the heat receiver with a handkerchief (so that the heat from the hand is not transmitted to the heat receiver) and we will apply pressure on it with the hand. By deforming the heat sink, we change the pressure of the gas and therefore change the internal energy of the gas in the heat sink. The gas, in turn, performs work on the column of liquid and raises its level in the free knee.

Let's illuminate the heat sink with the light from the table lamp. The thermal radiation of the lamp will be absorbed by the heat sink, and this will lead to heating of the gas, that is, to a change in its internal energy. The gas, in turn, will perform work on the column of liquid and raise the liquid level in the open knee of the pressure gauge [6].

In the inductive presentation of the material, the following stages can be distinguished: 1) setting a task (problem) that requires an experimental solution; 2) elucidation of the elements of knowledge that are supposed to be obtained experimentally (but not the message of knowledge itself); 3) drawing up a block diagram of the installation (drawing, drawing); 4) assembling the installation in front of students. In this case, the drawing is correlated with the elements of the installation. Sometimes parts of the installation (individual units) are assembled in advance, and only in rare cases the installation can be assembled in advance. However, in any case, the devices and accessories are put on the demonstration table only during the demonstration of the experience; 5) explanation of the installation. Finding out the purpose of individual devices and units, functional dependencies

between the elements of the installation; 6) demonstration of the phenomenon or process, accompanied by an explanation of what and how to observe, what to focus on, how to highlight the objects of interest to us, processes, new knowledge; varying experience, the teacher is not talking about the observed results, and organize the work so that in the conversation the students have noticed what is needed, and draw appropriate conclusions; 7) verbal, graphical or tabular recording of experimental data; 8) organization of work with students on identification of new knowledge obtained as a result of production experience, through comparison, abstraction, generalization. In the deductive presentation of the material changes the role of only 1, 2 and 8 highlighted below stages. Their meaning is as follows: the first stage-finding out the consequences of the theories that can be tested experimentally; the second stage-finding out the elements of knowledge that are supposed to confirm experimentally; the eighth stage-the organization of work with students to update the knowledge that confirms the conclusions of the theory and obtained as a result of the experience. At demonstration of experiences records in notebooks of pupils are possible (the name of experience, the scheme of installation, tables, the schedule, the conclusion). In each case, the teacher indicates what needs to be recorded at one stage or another of the experiment. The ability to organize the solution of experimental problems involves the ability to choose the equipment for the problem, knowledge of methods and organizational forms of the solution and compliance with the stages of the solution. The problem is called experimental, the data for the solution of which are obtained empirically (i.e. without an experiment, the question of the experimental problem cannot be answered). To solve the experimental problem, both demonstration and laboratory equipment can be used; it can be solved by both teacher and students (frontally or individually) [6].

Conclusion. It is important to follow the requirements for demonstration experiments when solving problems with the use of demonstration equipment. The solution to the experimental problem consists of four stages: 1) understanding the conditions of the problem; 2) planning solutions; 3) implementing the plan; 4) survey response. The first stage involves familiarity with the problem condition, which contains statements and requirements, as well as a list (full or partial) of devices and materials required for the experiment, an assessment of the physical situation according to the problem condition. In the second stage, a theoretical search path is developed, the procedure for conducting the experiment is planned; if necessary, devices or materials are added. The third stage is aimed at the implementation of the experiment, as a result of which the missing experimental data are obtained. This data is used to obtain a response. At the last stage, they check the plausibility of the answer, analyze the results of the experiment, and search for other ways to solve problems.

Thus the formation of general education skills in molecular physicsreveals students:
Educational and cognitive skills;
ability to make a plan of response, speech;
Ability to write a review, annotation;
Ability to read and write at the pace set by the teacher;
Participate in educational dialogue, debate, discussion.
Ability to prove:
The ability to use the language of the science that underlies the subject
Practical and research skills
Ability to observe
Ability to put experiments;
Carry out measurements;
Search and information;
Ability to handle dictionaries reference books, electronic media
Educational and organizational
Ability to plan current and future academic work
The ability to set learning objectives
Ability to act on the algorithm
To cooperate in the solution of educational tasks (to help a classmate, to explain, to accept help)
Ability to work in a group
Educational and intellectual skills

Ability to classify
Ability to generalize
Ability to highlight the main and essential
Ability to establish causal relationships
Ability to find associations and use them
Educational and cognitive skills
ability to make a plan of response, speech
Ability to write a review, annotation
Ability to read and write at the pace set by the teacher
Be a participant in the academic dialogue, debate, discussion.
Ability to prove
The ability to use the language of the science that underlies the subject
Practical and research skills
Ability to observe
Ability to put experiments
Carry out measurements
Search and information
Ability to handle dictionaries reference books, electronic media
Educational and organizational
Ability to plan current and future academic work
The ability to set learning objectives
Ability to act on the algorithm
To cooperate in the solution of educational tasks (to help a classmate, to explain, to accept help)
Ability to work in a group

In the process of laboratory work, each student must master the following knowledge, skills and abilities:

1) be able to assemble any installation according to diagrams and descriptions;
2) know the purpose and rules of operation of the main equipment in physics for secondary schools;
3) to master the technique and technique of demonstration of school physical experiments;
4) be able to explain the phenomena demonstrated at the level of a secondary school teacher;
5) instill skills in compliance with safety regulations when performing experiments.

The study confirmed that with effective lesson planning, the level of development of General educational skills increases if students independently perform a certain set of interactive tasks developed on the content of the topic in physics when fixing the studied topic.

As can be seen, educational and cognitive activity, in this case, is associated with the tasks solved with the involvement of research methods providing for the creative assimilation of knowledge in physics. Examples can illustrate to students that it is impossible to predict at what speed a single molecule will move, and in what place it will be at any given time. However, it is possible to calculate, under certain conditions in which the gas is located, the proportion of molecules moving at a given speed, or the proportion of those that will be in a given volume. But actually, this is what you need to know, since the main characteristics of the gaspressure, temperature, density, etc. - are determined not by the complex behavior of one molecule, but by their combined action (statistical, synergistic effect).

Therefore, the specificity of the objects under study necessarily affects the nature of evidence and justification of knowledge, explanation and description, as well as its construction and organization. So, realization of these moments along with assimilation of new value (formation of statistical representations) leads to formation of action on application of this value. In this situation, students come to understand that the pressure of a gas on a surface that limits it is identified with the average rate of momentum transfer by this surface per unit area due to molecular shocks. Finally, in a sequence of such reasoning is expressed in a certain way, cognitive activity, when implicitly assumes that all the gas pressure on the vessel wall due to the momentum transfer. Consequently, each new type of system organization of objects, for example, the real gas involved for consideration, as a rule, requires the transformation of previous representations. Indeed, as it turns out, the pressure of the

real gas includes a part due to the forces of interaction of molecules, which leads to a decrease in the pressure of the gas on the vessel walls. In the guidelines for conducting classes in molecular physics, the attention of students is focused on the fundamental need to move to the consideration of statistical averages.

Analyzing the deviation of the properties of real gases from similar properties of ideal, the causes of these deviations are highlighted-the presence of intermolecular interaction forces and their own volume in the molecules of real gas, characterizing their essential sides and properties. In process of deepening in concrete dependencies all new abstractions as introduction of the correction on own volume of molecules and forces of intermolecular interaction which act as deeper display of essence of intermolecular interactions are entered (the Van der Waals equation) [8].

Students analyze a great number of possible ways to study the laws describing the behavior of a real gas and taking into account the forces of intermolecular interaction. It should be reported that the subsequent study of the properties of real gases was associated with the search for equations of state, which has a strictly theoretical basis. It is shown that one of these equations was the equation of state in virial form. It allows us to explain the results of the macroscopic experiment from the position of intermolecular interactions and to reveal that these forces mutually bind many different macroscopic properties of matter. Thus, students are convinced that unlike the Mendeleev-Clapeyron law, the Van der Waals equation expresses the behavior of real gases more definitely. Therefore, the study of gas equations forms complex fundamental concepts in students, using the allocation of interrelated levels of knowledge development, which are the most important conditions for their formation and assimilation.

The ordering of the fundamental ideas of molecular physics is of more general importance for the mental development of the student, especially for the development of imagination and theoretical thinking. In this regard, it should be emphasized that mastering the basics of scientific knowledge contributes to the effectiveness of the learning process.

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Молекулалық физикадан жалпы оқыту дағдыларын қалыптастыру

Аннотация. Бүгінгі таңдағы біздің білім беру саласының алдына қойған мақсаты-қоғамдағы адамның әлеуметтік-құндылық қызметіне қажетті жеке қасиеттерін дамыту. Онда білім, білік, дағды мен құзыреттілік тұлғаның барлық маңызды қасиеттерінің толық дамуына қол жеткізуді қамтамасыз ететін негіз ретінде қарастырылады. Оның ішінде, физикалық құбылыстарды көрсету мұғалімге физикалық құбылыстарды бақылау және зерттеу арқылы оқушылардың танымдық қызметін бағыттауға мүмкіндік береді. Физикалық эксперимент арқылы түрлі міндеттер шешіледі. Физика - эксперименттік ғылым. Физикалық эксперименттің көмегімен оқытудың әртүрлі міндеттері мен мақсаттары шешіледі.

Мақалада молекулалық физика бойынша тәжірибелер мен олардың нәтижесі қарастырылады. Студенттердің нақты газдың жалпы сипаттамаларын және молекулааралық өзара әрекеттесудің күштерін ескеретін заңдарды үйренуінің бірқатар мүмкін жолдары талданады. Сонымен қатар, Ван-дер-Ваальс теңдеуінің Менделеев-Клапейрон заңынан айырмашылығын біледі және бұл теңдеудің нақты газдардың күйін шынайы сипаттайтындығына көз

жеткізеді. Сондықтан газ теңдеулерін зерттеу студенттер арасында күрделі іргелі ұғымдарды қалыптастырады, олардың қалыптасуы мен ассимиляциясының маңызды шарттары болып табылатын білім дамуының өзара байланысты деңгейлерін бөлуді қолданады.

Молекулалық физиканың негізгі идеяларын ретке келтіру олардың ақыл-ой дамуы үшін, әсіресе, қиял мен теориялық ойлауды дамыту үшін жалпы маңызға ие. Осыған байланысты ғылыми білім негіздерін меңгеру оқу процесінің тиімділігін арттыруға ықпал ететіні сөзсіз.

Түйін сөздер: физикалық эксперимент, молекулалық физика, білім, білік, дағды.

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Формирование общеобразовательных умений по молекулярной физике

Аннотация. Сегодня наше образование поставило перед собой цель - развивать личностные качества, которые необходимы для социально-ценностной деятельности человека в современном обществе. Знания, умения, навыки и компетенции обеспечивают достижение полного развития всех важных качеств личности.

Демонстрация физических явлений позволяет учителю направлять познавательную деятельность учащихся через наблюдение и изучение физических явлений. Физико-экспериментальная наука. С помощью физического эксперимента решаются различные задачи и цели обучения.

В статье рассматриваются опыты по молекулярной физике и их результаты. Анализируется ряд возможных путей усвоения учащимися законов, учитывающих общие характеристики конкретного газа и силы межмолекулярных взаимодействий. Кроме того, учащиеся изучают отличие уравнения Ван-дер-Ваальса от закона Менделеева-Клапейрона и убеждаются, что это уравнение верно описывает состояние реальных газов. Изучение газовых уравнений формирует у учащихся сложные фундаментальные понятия, при этом используется распределение взаимосвязанных уровней развития знаний, являющихся важнейшими условиями их формирования и усвоения.

Упорядочение основных идей молекулярной физики имеет большое значение для их умственного развития, особенно для развития воображения и теоретического мышления. В связи с этим овладение основами научных знаний, несомненно, будет способствовать повышению эффективности учебного процесса.

Ключевые слова: физический эксперимент, молекулярная физика, знания, умения, навыки.

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