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TECHNOLOGY FOR DEVELOPMENT OF STUDENT CREATIVE ACTIVITY IN MOLECULAR PHYSICS PROBLEM SOLVING

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Abstract
By solving problems from the molecular physics section of the physics course, the student is encouraged to think, analyze, imagine physical phenomena and processes. It is the basis for the development of his creative activity.

Keyword: position, ability, reflexive-perceptive ability, project, combination, problem in technical content, experiment, concentration.

The pedagogical position of modern pedagogues is directly related to the level of development of pedagogical abilities of students.

Ability is a characteristic of a person to successfully solve tasks in one or more directions. The ability is not passed from generation to generation, but some physiological and anatomical aspects can be inherited. Abilities develop. Ability is defined not by knowledge but by speed of work style, deep creativity and strong reliability. Abilities are a set of individual skills related to the object of education, tools, working conditions, and an elegant sense of effective ways to achieve high results.

General and specific abilities are distinguished in science.

General abilities are characterized by mental operations, strong observations, interesting communication, easy absorption of social experiences and determine high results in the desired field.

Special abilities determine the high results of a particular direction in areas that require special skills, such as music, visual arts, mathematics, theater.

Thus, abilities are a set of individual skills associated with a refined sense of the object of human education, tools, conditions of activity and effective ways to achieve high results.

There are two interrelated levels of pedagogical competence:

1."Reflexive-perceptive skills" are oriented towards the "Object-subject" relationship and require the development of the personal feeling experience of the pedagogue.

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2."Project Capability" will be focused on "Subject-Subject" relationship. It embodies the aspects that will help the teacher to strive for excellence in the professional field, if it is the formation of the need for the development of thinking in the student, the desire to find his place. This is determined by the development of modular knowledge and skills related to the design of the educational system.

One of the ways to develop students' abilities in a physics course is problem solving. By solving the problems, the students will determine the subject of the physics department in which the problem is given. It generates formulas based on the condition of the issue on the subject. He reads the problem and imagines the event or process in the condition of the problem. Analyzes a phenomenon or process. He looks for ways and means to solve the problem.

Solving problems in higher education institutions should be clearly planned, like other activities. Preparing for the lesson on the topic specified in the program, the teacher selects the problems and determines the sequence of solving them. The structure of the selected issues should satisfy a number of didactic and methodical requirements. The main didactic requirement is the gradually increasing complexity of the connection between the quantities and concepts describing the process or phenomenon described in the problem.

It is better to start by solving problems on some topics related to the "Molecular physics" section of the physics course. After that, more complex computational, experimental and other problems are selected sequentially, with an increasing number of connections between the magnitudes and concepts that describe the phenomenon. More complex, incompletely informed problems combined with technical content can be the results of the structure of selected problems on a certain topic.

Issue 1. Dust particles with a mass of $m=10^{18}$ g are suspended in the air. Determine the air layer in which the difference in the concentration of dust particles does not exceed 1%. The air temperature is the same throughout its volume and is T=300K.

Solution: The concentration of the distribution of dust particles at equilibrium depends only on the coordinate along the vertical axis.

In this case, the Bolsman formula can be used for the distribution of dust particles.

$n = n_0 e^{W/kT}$ (1)

Because the power of theft in a homogeneous field

$W = mgh$ (2)

Based on (2) and (1), we form $n = n_0 e^{mgh/kT}$ (3).

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Variation of concentration depending on height according to the condition of the matter $n\left|\frac{\Delta n}{n}\right| = 0{,}01$

is very small compared to Therefore, the concentration changes
Δn can be replaced by differential Δn. Differentiating the expression (3) with respect to z, we get the following

$$dn = n_0 \frac{mg}{kT} e^{mgZ/kT} dZ \quad (4)$$

Here $n_0^{\;mgZ/kT} = n$ (5) , since $dn = \frac{mg}{kT} ndZ$ (6). From this equation, we find the coordinate transformation we are interested in.

$$dZ = \frac{kT\Delta n}{mgn} \qquad (7)$$

Here, the negative sign is the positive change of coordinates ($dZ > 0$) means that it leads to a decrease in concentration. Since the negative sign is not important in this problem, the differentials ΔZ dZ and dn *are* and Δn replaced by a completed accretion.
$\Delta Z = \frac{-kT}{mg} \cdot \frac{\Delta n}{n}$ (8) we find. We put the magnitudes in the expression (8):

$\frac{\Delta n}{n}$ =0.001; k=1.38*10 $^{-23 J|K}$; m=10 ^{21} kg; g=9.8 m/s ^{2}; $\Delta Z = 4{,}23mm$ b dies.

According to the obtained results, the following can be said. The concentration of a very small dust particle also changes very rapidly with height.

Issue 2. Find the molar mass of a mixture of μ oxygen with a mass of *m = 25 g and nitrogen with a mass of m = 75* g

Solution. The molar mass of the mixture is μ_{ar} equal to the ratio of the mass m_{ar} of the mixture to the amount of substance in the mixture , i.e. ν_{ar}

$$\mu_{ar} = \frac{m_{ar}}{\nu_{ar}} \; (1)$$

The mass of the mixture is equal to the sum of the masses of the constituents of the mixture $m_{ar} = m_1 + m_2$:

The substance amount of the mixture is equal to the sum of the substance amounts of the constituents of the mixture

$$\nu_{ar} = \frac{m_1}{\mu_1} + \frac{m_2}{\mu_2}$$

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μ_{ar} and ν_{ar} into the formula, we get the following

$$\mu_{ar} = \frac{m_1 + m_2}{\frac{m_2}{\mu_1} + \frac{m_2}{\mu_2}}$$

We find the molar masses of oxygen μ_1 and nitrogen μ_2

$$\mu_1 = 32 \cdot 10^{-3} kg/mol, \quad \mu_2 = 28 \cdot 10^{-3} kg/mol$$

We put the values of the quantities in (2) and calculate:

$$\mu_{ar} = \frac{25 \cdot 10^{-3} + 75 \cdot 10^{-3}}{25 \cdot 10^{-3}/(32 \cdot 10^{-3}) + 75 \cdot 10^{-3}/(28 \cdot 10^{-3})} kg/mol =$$

$$28{,}9 \cdot 10^{-3} kg/mol.$$

Issue 3. A cylinder with a volume of *V=6.9 l* **contains** nitrogen with a mass of *t=2.3 g* . During heating, some of the molecules are dissociated into atoms. Dissociation coefficient* $\alpha = 0{,}2$ 1) Total number of nitrogen molecules before heating N_1 and concentration of nitrogen molecules n_1 ; 2) determine the concentrations of nitrogen molecules n_2 and atoms n $_3$ after heating.

Solution . By definition, the concentration of gas particles is equal to the ratio of the number of particles to the volume of the container occupied by the gas:

$$n = \frac{N}{V}. (1)$$

1. of gas molecules before heating is N $_1$

$$N_1 = \nu \cdot N_A = \frac{m}{\mu} N_A = \frac{m}{k\mu_r} N_A (2)$$

we find from the relationship. In this case , the ν amount of nitrogen; N_A — Avogadro's constant; μ — molar mass of nitrogen; μ_r —relative molecular mass of nitrogen; k= 10 $^{-3}$ kg/mol

If we put the values of the magnitudes in (2),

$$N_1 = \frac{2{,}3 \cdot 10^{-3}}{10^{-3} \cdot 8} \cdot 6{,}02 \cdot 10^{23} = 4{,}94 \cdot 10^{23} \text{ single molecule.}$$

n $_1$ by putting the value of the quantities in (1):

$$n_1 = N_1/V = 4{,}94 \cdot 10^{23} / (6{,}9 \cdot 10^{-3}) m^{-3} = 7{,}16 \cdot 10^{25} m^{-3}$$

2. After heating, concentrate

$$n_2 = \frac{N_2}{V} = \frac{N_1(1-\alpha)}{V} (3)$$

we find from the relation. Here, N_2 is the number of molecules that are not separated into atoms.

Putting the values of the quantities in (3), we get the following:

$$n_2 = \frac{4{,}94 \cdot 10^{23}(1-0{,}2)}{6{,}9 \cdot 10^3} m^{-3} = 5{,}73 \cdot 10^{25} m^{-3}.$$

Concentration of atoms after nitrogen is heated:

$$n_3 = \frac{2N_1\alpha}{V} \quad (4)$$

The number 2 in the formula (4) represents that each molecule breaks down into two atoms. We put the values of the quantities in (4) and calculate:

$$n_3 = \frac{2 \cdot 4{,}94 \cdot 10^{23} \cdot 0{,}2}{6{,}9 \cdot 10^{-3}} m^{-3} = 0{,}286 \cdot 10^{26} m^{-3} = 2{,}86 \cdot 10^{25} m^{-3}$$

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