Formation of Skills for Solving Professionally Oriented Problems in the Field of Molecular Physics

Bozorova Saodat Djamolovna
Navoi State Mining Institute, Doctor of Pedagogical Sciences, Professor of the chair "General Physics

Baichaev Fazliddin Khusenovich
Navoi State Mining Institute, assistant teacher of the chair "General Physics"

ABSTRACT

The article shows how to increase the efficiency of practical training in the training of future specialists in the mining and metallurgical industry through the formation of professionally oriented problems in physics.

KEYWORDS: *mining and metallurgical industry, education, production, practical training, professionally oriented tasks.*

At that time when the process of qualitative renewal is taking place in all layers of our society, the education system is entering a new stage in its history, special attention is paid to the creation of an integrated flexible system of lifelong education, the integration of education and production is recognized as a priority. In the process of modernization of higher education in our country, the main quality requirement remains the training of qualified specialists.

Currently, technical universities carry out systematic work to improve the teaching of physics on the basis of a competent approach, improve the quality of didactic support, develop students' creative thinking, use modern educational technologies to meet the needs of creative and competent specialists.

Particular attention is paid to research work on the development of students' creative thinking skills when studying physics, increasing their professional competence, ensuring the connection between theory and practice in teaching physics.

To further development the quality and efficiency of education in recent years, the priority area has been to increase the potential of high-quality educational services, training highly qualified personnel following the modern needs of the labor market. The decree "On measures to improve the quality of education and research in physics" defines such priorities as in-depth teaching of sciences, the creation of an effective mechanism for the implementation of scientific and innovative achievements. This requires improving the methods of teaching physics in universities on the basis of a competent approach. It is no coincidence that the President said that "the strengthening of competition in the context of globalization requires the development and implementation of a completely new approach and principles for a more stable and dynamic development of our country." Incomplete development of pedagogical conditions, mechanisms, methods and technologies for the formation of leading professionals for industrial enterprises, insufficient integration of education and production in the development of professional competencies of students, incomplete integration of theory and practice gives rise to the need for a comprehensive revision.

The study of the application of the topics of practical classes in physics in the mining and metallurgical industry and the formation of professionally oriented problems that reveal the content of the laws of physics in production, provides the basis for the development of continuity between science and production. When formulating professionally oriented tasks for practical training, the teacher must have a clear idea of the didactic goal, that is, the formation of a clear system of ideas about the application of physical laws in the mining and metallurgical industry.

Based on the usage of the topics of the physics section "Molecular Physics" in the mining and metallurgical industry, based on the needs of the customer companies to ensure the effectiveness of specialized practical training, the following topics are recommended:

Molecular physics and thermodynamics	
Topics by physics section	**Applying in the mining and metallurgical industry**
The basic equation of the molecular kinetic theory of gases. Average kinetic energy of molecules. Absolute temperature.	Temperature concept for rocks and minerals
The degree of freedom of molecules. Internal energy. Work done by gases as they expand. 1st law of thermodynamics. Specific heat. Adiabatic process.	Heat capacity of rocks. Change in the properties of a substance under the influence of heat.
The first law of thermodynamics and its application to iso and adiabatic processes. Classical theory of heat capacity.	The importance of the first law of thermodynamics in the study of the properties of rocks.
Maxwell-Boltzmann distribution laws. Barometric formula. Avogadro constant.	The laws of pressure change in mines
Transport phenomena in gases. Effective molecule diameter, average path. Diffusion. Heat transfer. Internal friction. Internal friction coefficient.	Distribution of rocks, the phenomenon of heat transfer in them.
Reversible and irreversible processes. Heat engine. Carnot cycle. coefficient of performance. II law of thermodynamics. Entropy.	Entropy of rocks
Joule Thomson effect. Real gases. Experimental isotherms. Van der Waltz equation. Molecular forces. Phase transitions of type I-II.	Phase transitions in rocks

Future specialists in the system of the mining and metallurgical industry are recommended to draw up tasks using the example of minerals extracted from the subsoil. The main task is to study the composition of rocks and determine how many minerals they contain. The solution of such structured problems leads to a more thorough study of the rock composition.

For this purpose, to effectively conduct practical classes, it is recommended to solve problems from the physics section “Molecular Physics” on the basis of current technologies in the mining and metallurgical industry.

Task 1. Calculate the amount of iron in the ore containing ferric oxide, ie. hematite - Fe_2O_3.

The ratio of the mass of a given substance x to the total mass of the system constituting this substance is called the mass fraction of the substance x.

$\omega(x) = \frac{m(x)}{m}$

where ω (x) - x is the mass fraction of x, m (x) is the mass of x, and m is the total mass of the system.

Mass fraction of a substance is a dimensionless quantity, which is expressed in fractions or percentages of a unit. In this case, the mass fraction of iron in hematite

$\omega(x) = \frac{m(x)}{m} = \frac{2M_r(Fe)}{M_r(Fe_2O_3)} = \frac{2\cdot 56}{160} = 0{,}7$ или 70%

Task 2. From a rock weighing 25 g, containing the mineral argentite (Ag2S), 5,4 g of silver were extracted. Determine the mass fraction (%) of argentite in the composition of this rock.

For this, we find the content of the silver substance in the Argentine mineral. When finding the amount of a substance, we determine its mass by molar mass:

$\nu = \frac{m}{\mu}$

$\nu = \frac{5{,}4}{108} = 0{,}05$ mole.

The chemical formula of the mineral argentite (Ag2S) implies that the substance of argentite is 2 times less than that of silver. In this case, the amount of argentite substance

$\nu_{\mathrm{A}} = 0.5 \cdot 0.05 = 0{,}025$ mole

Determining the molar mass of the argentite mineral in a rock fragment, we find its rock mass:

$\mu_{\mathrm{A}} = M_r(Ag_2S) \cdot 10^{-3} = (2 \cdot 108 + 32) = 248 \cdot$ g/mole

$m_A = \nu_A \cdot \mu_A = 0{,}025 \cdot 248 = 6{,}2$ g

Now we find the mass fraction of the Argentine mineral in a piece of rock weighing 25 g:

$$\omega(Ag_2S) = \frac{m_A}{m} = \frac{6{,}2}{25} = 0{,}248$$

Task 3. If the content of mineral pyrite (gray, iron ore) is 46.6% Fe, 53.4% S, determine its average molar mass.

The average molar mass of a complex substance, consisting of individual substances with different molar masses, is determined by the arithmetic mean of their mass fractions.

$\mu_{\text{ср}} = \frac{\sum_{i=1}^{n} \nu_i \cdot \mu_i}{\sum_{i=1}^{n} \nu_i}$ (8)

The amounts of all substances that make up a substance are $\sum_{i=1}^{n} \nu_i = 1$, then the average molar mass of a substance is:

$$\mu_{\text{ср}} = \sum_{i=1}^{n} \nu_i \cdot \mu_i$$

If a substance is specified in mass fractions, then the average molar mass and their mass fractions are found as follows:

$\mu_{\text{ўрт}} = \frac{\sum_{i=1}^{n} \omega_i}{\sum_{i=1}^{n} \omega_i / \mu_i}$ (9)

If consider $\sum_{i=1}^{n} \omega_i = 1$, then, $\mu_{\text{ср}} = \frac{1}{\sum_{i=1}^{n} \omega_i / \mu_i}$.

$$\mu_{cp} = \frac{\sum_{i=1}^{n}\omega_i}{\sum_{i=1}^{n}\omega_i/\mu_i} = \frac{46{,}6+53{,}4}{46{,}6/56+53{,}4/32} = \frac{100}{0{,}83+1{,}67} = \frac{100}{2.5} = 40 \text{ g/mole}$$

This means that the average molar mass of the pyrite mineral is 40 g / mole.

Task 4. Find the number of atoms in the quartz-SiO2 mineral weighing 2 kg.

Since the mass of an atom or molecule in a substance is measured in atomic units (m.u.), the relative masses of atoms in the periodic table are given. If a substance is composed of several other substances, we find its relative molecular (atomic) mass using the following expression:

$M_r(ABC...) = n(A)\ A_r(A) + n(B)\ A_r(B) + n(C)\ A_r(C)+...$

where n indicates how many molecules (atoms) are in the substance.

For this, we determine the atomic mass of the substances that make up quartz from the periodic table and find the relative atomic mass:

$$M_r(SiO_2) = 1 \cdot 28 + 2 \cdot 16 = 60 .$$

If the mass of the molecule is m0, the molar mass by Avogadro's number has the following expression:

$$\mu = m_0 \cdot N_A$$

If we consider that the relative atomic mass of a substance is related to its molar mass by the following relationship,

$$\mu = M_r \cdot 10^{-3} \text{ kg/mole}$$

The molar mass of quartz, which is a rock, is μ = 60 · 10 ^ (- 3) kg / mole.

To find out how many moles a substance of a given mass consists of, it is necessary to take the ratio of its mass to its molecular mass:

$$\nu = \frac{m}{N_A}$$

If it is necessary to find the amount of substance in 2 kg of quartz rock, then its mass must be divided by Avogadro's number:

$$\nu = \frac{m}{N_A} = \frac{2}{60} = 0{,}03 \text{ mole}$$

To determine the number of molecules in a substance of any mass according to Avogadro's law, multiplying this number by the number of moles:

$$N = \nu \cdot N_A = 0{,}03 \cdot 6{,}02 \cdot 10^{23} = 2 \cdot 10^{22}$$

Therefore, the number of atoms in 2 kg of quartz is 2 1022.

It will be advisable if professionally oriented tasks are recommended to consolidate the topic.

1. Find the relative molecular weights of the following breeds.
2. Halite (rock sol, common sol) - NaCl, fluorite - CaF2, anhydrite - CaSO4, dolomite - CaMg [CO3] 2, calcite (limestone) - CaCO3, olivine - (Mg, Fe) 2 [SiO4], magnetite - FeFe2O4, hematite - Fe2O3, corundum - Al2O3, pyrite (sulfuric, iron pyrite) - FeS2, cinnabar - HgS, chalcopyrite (copper pyrite) - CuFeS2, sphalerite - ZnS, galena - PbS,
3. Find the amount of substance in Fe2O3 - hematite weighing 2.5 kg.
4. Find the number of atoms in CaCO3 - calcite (limestone) weighing 7 kg.

5. If the rock consists of calcite, indicate the average molar mass of CuO 56%, CO2 44%.
6. Determine the average molar mass of the rock with the chemical composition CaO 32.5%, SO3 46.6%, H20 20.9%.
7. Find the average molar mass of a rock called "fluorite (feldspar)" containing 51.2% Ca, 48.8% F.
8. If the chemical composition of a rock called dolomite consists of CaO 30.4%, MgO 21.7% CO2 47.9%, determine its average molar mass.
9. Find the average molar mass of the mineral "augite" with CaO 25.9%, MgO 18.5%, SiO2 55.6%.
10. If the composition of the magnetite mineral is FeO 31%, FeO3 69%, determine its average molar mass.
11. Determine its average molar mass, if the composition of the mineral cinnabar (red resin) Hg 86.2%, S 13.8%.
12. Find the average molar mass of chalcopyrite (copper puddle) if the composition of the mountain mineral is Cu 34.57%, Fe 30.54%, S 34.9%.
13. Determine the average molar mass of the mineral sphalerite (zinc blende), which consists of the substances Zn 67.1%, S 32.9%.
14. If the composition of the mineral galena Pb - 86.6%, S - 13.4%, find its average molar mass.

Creating a system of practical tasks (logical tasks) on a topic, choosing the necessary tasks for a specific lesson, calculating the time to solve each of them, developing a plan of practical lessons will increase the effectiveness of the educational process.

Thus, the main conclusion of the experimental work is that the key to achieving the goals of studying physics in technical universities is the technologization of the educational process, it is proved that specialization is a guarantee of high-quality preparation for future applied activities.

References:

1. Resolution of the President of the Republic of Uzbekistan dated March 19, 2021 No. PP-5032 "On measures to improve the quality of education and the development of scientific research in the field of physics."
2. Bazarova S.J, Baychaev F. Kh. Vocational-oriented practical training is a factor in the development of the integration of education and production. Journal of Advances in Engineering Technology "ttps: //sciencealgorithm.uz. Navoi, Uzbekistan. Vol.1 (1), September, 2020.82-85.
3. Shagina Yu.V. "Formation of professional competencies of future engineering specialists in the context of the integration of education, science and production" Author's abstract: dis. Candidate of Pedagogical Sciences. - Samara .: 2010 .-- 23 p.
4. Zeer, E.F. Psychology of vocational education - M.: Publishing house of the Moscow Psychological and Social Institute; Voronezh: Publishing house NPO "MODEK", 2003. - 480 p.
5. Budishcheva N.N. Competence-activity approach as the basis for modernization of the content of education // Actual problems of modernization of the capital's
6. Atlyaguzova U.I. Formation of basic competences of students of a technical profile: abstract of thesis: dis. … Doctor of Pedagogical Sciences. - Togliatti., 2011. -- 23 p.
7. Lavrinenko S.V. "Optimization of professionally oriented training of students in a modern technical university" Author's abstract:dis. Candidate of Pedagogical Sciences. - Veliky Novgorod .: 2019 .-- 25 s