
# Methodology Of Solving Problems from Physics and Solutions in Secondary Schools

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**ABSTRACT**

The article develops a methodology for solving problems related to isothermal processes in physics in secondary schools.

**Keywords:** mental, school, isothermal, isothermal, isobaric, isochoric, adiabatic, thinking, memory, attention, heat, event, practical skill, skill, matter, type, experimental, qualitative, quantitative

Problem solving allows the learner to develop mentally, helping to develop logical thinking, memory, attention and comprehension. Problem solving is the main criterion for the study and mastery of physics. In the process of problem solving, the student develops practical skills, competencies and competencies to apply his theoretical knowledge in the analysis of various physical phenomena and processes in nature, technology and life. These include: drawing, drawing, diagrams, charts and diagrams, using tables and references, performing calculations, developing theoretical knowledge, practical skills, competencies and competencies for the use of equipment in solving experimental problems

The selection, construction and solution of different types of problems related to isothermal processes in the teaching of physics form the skills and abilities of students to apply theoretical knowledge in practice.

Students have to solve many problems from physics in daily life and production. This means that students should not only be able to solve different types of problems related to isothermal processes, but also be able to apply generalized methods in solving problems of any creative description. Different types of problems from physics to isothermal processes are not only a means of acquiring and deepening theoretical knowledge, but also to connect school with life, to prepare students for practical activities.

Selecting, constructing, and solving different types of problems on isothermal processes in physics, combining theory with practice, allows students to develop skills and abilities, deep and thorough mastery of knowledge.

Before selecting, constructing, and solving different types of problems related to isothermal processes from physics, the analysis of the problem condition begins with the teacher's explanation. At the same time, attention is drawn to the quantities sought by students in the context of the problem and to the physical foundations of the ecology of the region. The next step in solving different types of problems from physics to isothermal processes is to write a summary of the problem condition. Determining the system of units is important in selecting and solving a problem. It then moves on to addressing this issue directly, which is the key to these steps.

The solution of different types of problems selected from physics on isothermal processes consists in explaining its physical essence, the physical processes and phenomena described in it. Thus, the selection, construction, and solution of different types of problems related to isothermal processes in physics, such as the steps in solving traditional problems, include:

1. Read the case condition.
2. Explain the meaning of ambiguous terms and recall relevant concepts in memory.
3. Initial analysis of the issue.
4. Briefly write the condition of the case.
5. Determining the units of quantities in solving a problem and expressing them in SI.
6. Write formulas related to the problem, create tables, draw graphs.
7. Find the numerical values of the quantities.
8. Interpret the physical nature of the answer.

From physics, it is advisable to recommend different types of selected and structured numerical problems on isothermal processes in grades 6-11. Students are aware of the need for directly theoretical knowledge to solve structured physics problems related to isothermal processes. In a system of various forms of linking physics teaching to isothermal processes, the selection, construction, and solution of such problems are important links in the linking of theory and practice. However, in practice, the set of problems in physics used for general secondary schools has almost no physics problems that characterize the nature of our country. The school also faces difficulties in teaching teachers how to choose and solve different types of problems related to the physical basis of isothermal processes. With this in mind, we selected different types of physics problems for isothermal processes.

In the process of solving different types of problems from physics to isothermal processes, it allows students to be introduced to various interconnected processes or thermal phenomena. We know that the selection, construction, and solution of different types of problems related to isothermal processes in physics are divided into two parts, namely, physical and mathematical. The first part consists of explaining the state of physical processes and the content of the problem, determining the numerical relationship between certain quantities, writing formulas, constructing equations based on this or that theoretical and experimental data. The mathematical side consists of substitutions of various kinds, the solution of an equation constructed to find the quantity sought by applying mathematical rules, as well as a calculation.

**Issue 1.** In a vertical tube with the bottom closed, there is air trapped by a mercury column h1 = 30 cm high: how much (Δh) does the mercury column fall when the temperature changes from t1 = 270 C to t2 = -230 C?

Given:
h1 = 30 cm = 0.3 m;
T1 = (273 + 27) K = 300 K;
T2 = (273 - 23) K = 250 K.
Need to find: Δ h -?

Solution. If the volume of the air column in the tube at temperature (T1) is V1, and at temperature (T2) is V2, according to Gay-Lussac's law, the following formula can be written:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

where: V1 = Sh1 and V2 = Sh2 (the cross-sectional area of the tube), so Sh1 / T1 = Sh2 / T2 and h2 = h1. In this case, the drop of mercury in the tube is equal to:

$$\Delta h = h_1 \frac{T_1 - T_2}{T_1} = 0{,}3\ м \frac{300\ K - 250\ K}{300\ K} = 0{,}05\ м = 5\ см.$$

Answer: Δh = 5 · 10-2 m.

**Issue 2.** In the manufacture of electric lamps they are filled with inert gas at a temperature of t1 = 1500 C. At what pressure (P1) should the lamps be filled with gas so that the pressure at the temperature t2 = 3000 C, which occurs when the lamp burns, does not exceed P2 = 0.1 MPa?

Given:
T1 = (273 + 150) K = 423 K;
T2 = (273 + 300) K = 573 K;
= 0.1 MPa = 1 · 105 Pa.
Need to find: -?

Solution. Since the volume of an electric lamp does not change, the change in gas pressure in it depending on the temperature satisfies Charles's law, namely:

$$\frac{p_1}{T_1} = \frac{p_2}{T_2} \text{ бўлади.}$$

In this case, the pressure sought (P1) is equal to:

$$p_1 = p_2 \frac{T_1}{T_2} = 1 \cdot 10^5 \text{ Па} \frac{423 \text{ К}}{573 \text{ К}} = 74 \cdot 10^3 \text{ Па}.$$

Answer: r 1 = 74 · 103 Pa.

**Issue 3.** What is the pressure (r2) if the temperature of the gas in the cylinder is t1 = 1500 C, the pressure is P1 = 4 · 105 Pa, half of the mass of gas is expelled from the cylinder () and the temperature drops to t2 = 120 C?

Given:
r1 = 4 · 10-5 Pa;
T1 = (273 + 27) K = 300 K;
T2 = (273 + 12) K = 285 K;
Need to find: r2 -?

Solution. Given that the condition of the matter is, the following equation follows:

$$\frac{p_1 V}{T_1} = 2 \frac{p_2 V}{T_2}$$

the pressure (P2) sought is:

$$p_1 \frac{T_2}{2T_1} = 4 \cdot 10^5 \text{ Па} \frac{285 \text{ К}}{2 \cdot 300 \text{ К}} = \frac{2 \cdot 10^5 \text{ Па} \cdot 285 \text{ К}}{300 \text{ К}} = 1{,}9 \cdot 10^5 \text{ Па}.$$

Answer: = 1.9 · 105 Pa.

Before embarking on solving this problem, the teacher reminds the students to make sure everything is clear.

1. The condition of the matter must be read carefully to understand what is being said and demanded.
2. Physical analysis.
3. Determine how or in what way to solve the problem.
4. Perform the calculation.

Selecting, constructing, and solving problematic problems related to isothermal processes in physics form skills and competencies in students that include research, observation, deep thinking, and independent creativity. In solving problems of this content, the student seeks ways to directly connect theoretical knowledge with practice. Takes a deep and comprehensive approach to solving problems.

Problematic issues related to isothermal processes from physics form a scientific worldview in students, who begin to look for different ways to solve the problem. In solving problems related to isothermal processes in physics, the student relies on practice, that is, directly on the materials of the field and the results of the experiment. This proves the importance of practical activities based on theoretical knowledge. Problem solving is a factor of scientific research.

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