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A Systematic Approach to Creating Methods and Forms of Organizing Training in Solving Chemical Problems

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Abstract
This article examines the methods and forms of organizing classes in solving problems in chemistry in general secondary schools.

Keywords: System, algorithm, chemical problem, problem, quantitative calculus books, lesson.

Introduction

There are a lot of different chemical problems. Students often see something completely unfamiliar in each new type of problem, and a holistic system of knowledge and skills for solving them is not formed in their minds. The content of school chemistry course programs includes various types of problems. Teaching problem solving is one of the effective methods of teaching chemistry. It is well combined with other modern teaching methods. It is based on the activity and independence of students in acquiring knowledge. The use of their skills and abilities forms independence of thinking [1]. Problem solving by students contributes to a conscious and complete assimilation of the educational material, linking theoretical rules and laws with specific chemical processes. The great variety of problems does not allow them to be studied according to a template, which increases their value for learning and knowledge control, and at the same time causes difficulties for most students. All methods of solving problems can be conditionally divided into two groups: the method of successive approximations and the systematic method. However, regardless of this, the solution of any problem is divided into four main stages. The second stage is the development of a solution plan. The main difficulties at this stage are associated with the use of appropriate calculation formulas, the construction of algebraic equations or their systems. Most students do not know the chemical formulas of the reacting compounds and therefore cannot compose reaction equations, and some cannot insert coefficients into the equation. It is difficult to solve problems containing an incomplete set of data, it is understood that the student must determine the rest of the necessary information himself, which does not always give a result [2,3]. When solving any problem, this means that it is impossible to get the correct answer.

At the third stage, the solution is carried out directly. In calculation problems, the most common errors in calculations are ignorance of the units of physical quantities [4,5]. Errors in qualitative problems at this stage are diverse, for example, ignorance of safety precautions, ignorance of the properties of substances, or inability to assemble a device.

The fourth stage is testing the solution. Students often do not complete this stage of solving the problem [6].

The unity of the qualitative and quantitative aspects of chemical processes is the methodological basis for solving any computational problems in chemistry. They are followed sequentially, one after the other, and the absence or incorrect implementation of any of them leads to a negative result.

Based on the results of checking the performance of computational chemical problems, it is possible to assess the general level of development of the listeners. According to a number of authors, qualitative and experimental problems require a better understanding of chemical phenomena for their solution [7]. When performing them, it is impossible to perform them without understanding the properties of substances, chemical processes, without knowing the ability to assemble and disassemble devices, and without knowing the techniques of safe work with chemicals and equipment. There are two main approaches to organizing mental activity in solving problems: algorithmic and heuristic. They differ in the presence or absence of a guarantee and obtaining the correct result. Heuristics are procedures or descriptions that are relatively easy to apply and whose value is justified by previous experience in solving problems. However, unlike algorithms, heuristics do not guarantee success. The algorithmic approach to solving problems is based on some standard sequence of operations, the correct execution of which will certainly lead to the correct result.

These approaches are used in solving both qualitative and computational chemical problems, they have a no less qualitative developmental effect, requiring the student to have a broad outlook, to be able to connect disparate facts, to take it out of the scope of one subject, to take it beyond the scope of one topic, to search for connections with other disciplines of the natural science cycle. It is important to understand not only the chemistry of the phenomena occurring, but also their quantitative side. When the role of quantitative calculations is underestimated, the main attention of the teacher and students is focused on the descriptive part of the chemistry course, and quantitative laws are considered only in relation to the next, and do not form a unity with all the material studied. [8]. Some teachers separate the qualitative from the quantitative aspects of chemistry teaching, justifying their position by not having enough time to solve problems and by placing too much burden on students. However, students who study chemistry in conjunction with calculations demonstrate good problem-solving skills without compromising factual material.

In didactics, not algorithms in their mathematical definition, but "algorithmic recipes" or "algorithmic-type recipes" that have to some extent the basic properties of algorithms are widely used. The use of algorithmic recipes in solving chemical problems can be seen in the manuals of N.N.Oleynikov,G.P.Muraveva[9], I.V. Levchenko[10], .L.A. Yakovishin[11] and others. Only the most general algorithmic action recipe can be used in solving a chemical problem, for example, D.P. Erigin and E.A. Shishkin [67]

1. Read the text of the problem carefully, try to understand its essence.
2. Perform the chemical part of the problem solution: write the condition of the problem using the generally accepted symbols of quantities, record auxiliary data, analyze the problem and draw up a solution plan.
3. Choose the most rational solution.
4. Make the necessary calculations.
5. Write down the answer to the problem.
6. Check the result obtained (formulate and solve the inverse problem or another solution). A. Yu. Falkovskaya [13] recommends performing a similar sequence of actions when solving problems. Yu.V. Pletner and V.S. Polosin recommend the following algorithm [14]
1. If there is no printed text of the problem, write it in students' notebooks.
2. Before solving the problem, analyze it and draw up a solution plan.
3. Choose the simplest solution
4. Avoid unnecessary conversions from one unit of measurement to another
5. Try to solve problems in chemical units without translation as much as possible.
6. Give the answer to the problem in full.

Following a sequence of processes when teaching problem-solving helps students focus on their goals, helps organize their mental activity, and teaches them to perform successful operations in a sequential manner.

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