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THE ROLE OF MATHEMATICAL METHODS IN SOLVING CHEMISTRY PROBLEMS.

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Abstract: This article offers a methodology for teaching problem solving, provides information about mathematical methods. At the same time, the article examines the mathematical methods used in solving such problems in chemistry for chemical equilibrium, the equations of chemical reactions and the discriminant method.

Keywords: process, method, theoretical knowledge, decimal logarithm, chemical balance, quadratic equation, discriminant..

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For chemists, mathematics is primarily a useful tool for solving many chemical problems. It is difficult to find any branch of mathematics that is not used at all in chemistry. Functional analysis and group theory are widely used in quantum chemistry, probability theory is the basis of statistical thermodynamics, graph theory is used in organic chemistry to predict the properties of complex organic molecules, differential equations are the main tools of chemical kinetics, topology and differential sciences. geometry methods are used in chemical thermodynamics.

Mathematics develops new approaches to get to the heart of chemistry or solve problems, develops new chemical theories. To deepen your knowledge of chemistry, you need to have a good understanding of mathematics.

It is important for students to be able to independently work on problems and exercises to strengthen their theoretical knowledge of chemistry. In order to thoroughly understand the theoretical knowledge of chemistry, it is extremely necessary to be able to solve problems related to all branches of chemistry. The ability to solve problems allows school, lyceum and vocational college students, as well as students of higher educational institutions, to deeply study and understand many chemical processes and laws. In some manuals intended for students entering a higher educational institution, solving problems is considered a secondary task, and attention is not drawn to the characteristics of various types of problems and the method of solving them.

Nowadays, it is not a secret to anyone that the education organized based only on the work and skills of the pedagogue does not give good results. Now the main task of the pedagogue is not to give students ready knowledge, but to help them acquire knowledge independently. For this, it is necessary to improve the educational process to the extent that allows students to fully demonstrate their abilities and opportunities and spend all their energy on learning. Now, in the teaching process, effective use of various methods and teaching tools, which do not make students bored and guide them to think and work independently, is gaining importance. Because the student is considered an object in the traditional teaching process, but today he is becoming a subject.

Our goal is to introduce scientific and popular methods of solving problems in chemistry to students of general secondary schools, academic lyceums and vocational colleges, to use the most convenient methods of solving problems in chemistry, to solve problems of students' interest in chemistry. consists of increasing through The ability to solve problems allows students of general education schools, vocational schools, as well as students of higher educational institutions to deeply study and understand many chemical processes and laws. Improvement and complexity of test questions is the need of the times. Learning quick ways to find answers to these complex test questions is of interest to young people entering all higher education institutions. This requires the student to use convenient and quick methods of solving mathematical problems. One of such methods is the use of algebraic, decimal logarithm and discriminant equations in solving chemical problems. Solving chemical problems by discriminant method is analyzed below.

Completing a chemical task begins with recording its conditions. What is the way to solve the problem? What is the specific dynamic of knowledge that is included in the process of thinking? What connections are made? All this depends on the behavior of the student, the reality of the condition of the problem, and how he calculates and eliminates errors in it.

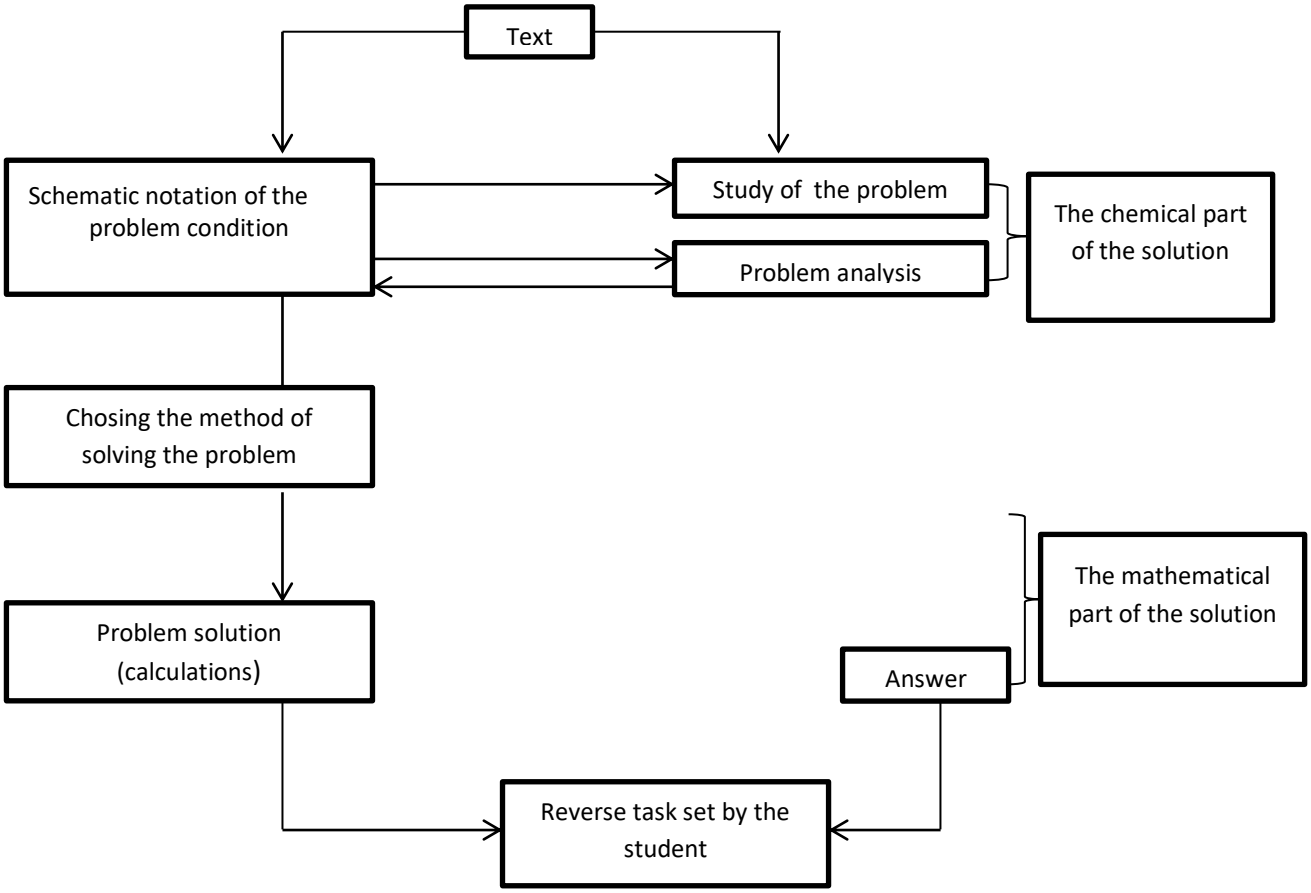

Figure 1. The scheme of the structure of the chemical problem

The rate of the correct reaction v1 decreases with time, because reactants A and B are used up and their concentration decreases. The rate of the reverse reaction, v2, increases, because as substances C and D are formed, their concentrations also increase. After a certain time tm has passed, the rates of opposite reactions become equal: v1=v2. A state in which the rate of forward and reverse reactions of a reversible process is equal is called chemical equilibrium. Because υ1 ·υ2 when the chemical equilibrium is established

k1[A]a ·[B]b=k2[C]c ·[D]d

From this,

KM is the equilibrium constant. The value of the equilibrium constant depends on the temperature of the nature of the reactants. The molar concentration of substances in a reaction system at equilibrium is called the equilibrium concentration. If the molar concentration of substance A before the start of the reaction is CA, then the equilibrium concentration [A] is accepted.

When the chemical equilibrium is established, the reaction does not stop, a dynamic (shiftable) chemical equilibrium is established between two opposing processes.

Example 1. In the equation below, the concentrations of substances (mol/l) written in the order of A+B↔C+D are 8, 3, 2, 12. In the system at equilibrium, 2

mol/l of substance C was released. Determine the new concentrations of substances A and D.

Solution: 1) Based on their equilibrium concentrations initially, the equilibrium constant is found.

2) New concentrations of substances A and D are found based on KM. The equilibrium constant of the system does not change, no matter how many substances are added to the system in equilibrium, no matter how many substances are removed from it.

3) If a certain amount is removed from the side of the reaction, x is added to this side, and x is subtracted from the opposite side. So,

8-x 3-x 2-2=0+x 12+x

A + B C + D

Based on this, the equation is created:

$$x+x^2=24-11x+x^2$$
$$12x+11x=24$$
$$23x=24$$
$$x=1,0435$$
$$x=1,0435$$

4) So, x is the amount added to C and D after leaving A and B. Based on this, the new concentrations of A and D will be:

[A]=8-1.0435=6.96 mol/l

[D]=12+1.0435=13.04 mol/l

5) The results are checked by substituting the found value to ensure accuracy.

Answer: [A]=6.96 mol/l; [D]=13.04 mol/l.

Example 2. If the initial concentrations of substances A and B in this A+B↔2C reaction are 0.5 and 0.7 mol/l, and the equilibrium constant of the reaction is equal to 50, determine their equilibrium concentrations.

Solution: Based on the reaction equation, if we denote the concentration involved in it by x, the equilibrium concentrations can be determined as follows:

$$=C_A — x_A = 0,5 — x$$
$$=C_B — x_B = 0,7 — x$$
$$=C_C — x_C = 0 +2x=2x$$

We determine the value of x by putting the parameters into the equilibrium constant formula:

From the resulting quadratic equation, we determine x1 and x2 using the discriminant method:

The value of x2 does not satisfy the problem. Because the value of x should not exceed 0.5. Now we determine the starting concentrations of substances A and B:

[A]=0.5 - 0.44=0.06 mol/l;

[B]=0.7 – 0.44=0.26 mol/l.

So the answer is 0.06 mol/l and 0.26 mol/l.

In conclusion, we can say that having good mathematical knowledge, one can successfully solve complex chemical problems. With the help of mathematics, it is possible to perform simple or complex mathematical operations on chemical formulas and chemical reaction equations. Almost any branch of mathematics is used in chemistry. Without knowledge of mathematics, it is impossible to solve any chemical problem, and at the same time, it is impossible to pass the exam.

Through this work, we have looked at several examples that show the application of mathematics in chemistry. We think that we have achieved the goal and mission that we set before ourselves.

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