ResearchJet Journal of Analysis and Inventions
https://reserchjet.academiascience.org
ISSN: 2776-0960 Volume 2, Issue 5 May, 2021

MATHEMATICS IN CHEMISTRY

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Abstract
Chemical problems and exercises serve as an important didactic means in the formation and development of mental and practical skills based on the theoretical knowledge acquired by students. In order to master the skills of solving chemical problems and exercises, it is important that students have a thorough theoretical knowledge and be able to perform various types of mental activities.

Keywords: chemistry education, school stage, synthetic analysis.

During our research, the content of various chemical problems and exercises, chemical BKMs that are expressed and it should be strengthened in them which is in various sources on teaching and learning of problem and exercise solutions [1; 2; 3; 4; 5] the following series of problems identified and their negative impact on the effectiveness of chemistry education today:

1. Inability to use class time effectively in developing skills to solve chemical problems and exercises;
2. Solving problems in a reproductive way, not giving them ideas about shorter methods of solving;
3. Difficulties for students in understanding the chemical problem, the nature of the exercises and methods of solving them;
4. Inability of students to distinguish between chemical (qualitative) and computational (quantitative) parts of computational problems;
5. In some cases, students make mistakes in the use of chemical language, computational operations and physical quantities;
6. Students do not try to solve the problem by solving it in other ways or by creating and solving a problem with the opposite content;
7. Students have a misconception that each chemical problem belongs to a different type;
8. Insufficient use of information on the practical significance of chemistry in the context of chemical problems and exercises.

At the school stage of chemistry education, students need to learn the following types of problem-solving skills [6]:

1. Problems concerning the formula of substances.
2. Problems on the equations of chemical reactions.
3. Problems of finding volumes of gaseous substances.
4. Problems of finding the density of gaseous substances.
5. Problems with solutions.

This chemical problems and exercises can be divided into several types. Examples of solutions include solubility, mass fraction of solute, percentage, molar and normal concentrations.

It is considered that students can consolidate their theoretical knowledge by solving chemical problems, use them effectively in changing conditions, work independently and have thinking ability, strengthen the study of chemical BCM on new topics during the school year, repeating them in a certain sequence and it is possible to be convinced of the importance of using issues and exercises in the form of homework.

During our research, we carried out a number of activities to address the above problems. In particular, didactic materials on the regular study of various chemical problems and exercises in chemistry classes with students, the formation and development of skills in solving chemical problems and exercises in a mathematical approach in several ways and their impact on the development of mental and practical skills have been experienced.

By teaching students how to solve chemical problems, it is possible for them to effectively learn problem-solving skills in a concise manner depending on the type of thinking, taking a creative approach to chemical problems rather than reproductively. It is precisely because these chemical skills are not effectively formed in students that they find it difficult to find solutions to chemical problems. In taking effective measures to prevent this negative situation, great care should be taken to ensure that students master the chemical BKMs thoroughly.

One of the most effective ways to achieve educational goals is to teach students to solve qualitative problems and exercises at the beginning of the school year, to teach them how to solve quantitative problems only after they have mastered them on the basis of theoretical knowledge. Only then they will consciously grasp the essence of the given problem and seek a solution to it. The inclusion of interesting information in the content of these qualitative and quantitative problems, which demonstrates the practical importance of chemistry, develops students' desire and interest in problem solving

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Quantitative problems can be divided into two parts - chemical and computational. In chemical problems, these two parts are inextricably linked, because changes in quality and quantity are closely interrelated. The very connection is considered the methodological basis for solving chemical problems. If the content of quantitative problems is analyzed, it can be seen that the qualitative problem is hidden in any computational problem, the problem cannot be solved by calculation without finding its solution. Therefore, it will be possible to develop quantitative problem-solving skills at the required level provided that the work aimed at the effective acquisition of chemical knowledge by students is carried out at the required level.

Solving problems related to solutions requires students to have a thorough understanding of chemical concepts such as the components of solutions, solubility, mass, volume, amount of substance, equivalent and equivalent mass. Solving the problem of determining the volume and density of gaseous substances requires knowledge of the molar volume of gas, the relationship between the molar mass, volume and density, Avogadro's number, Avogadro's law.

Before solving a problem, students will need to analyze the requirement of the problem.

The chemical problem can be analyzed in two ways [3; 7]:

1. From the quantities given in the case to the unknown quantities
(synthetic analysis method)
2. From the quantities to be found to the given quantities
(analytical analysis method)

The teacher should explain both ways in detail to the students as their thinking skills will be different.

The method of synthetic analysis finds answers to questions such as what is given in the context of the problem, what to find and how to use them. If the student has difficulty in determining the correlation between the quantities given and to be found, the use of the second method is recommended. In this method, the unknown quantity is paid to determine which theoretical concept or law can be applied to it. Once the answers to these questions are found, the direct and indirect relationship of the magnitude to be found with the quantities given in the case condition is determined.

For chemists, mathematics is primarily a useful means for solving many chemical problems. Functional analysis and group theory are widely used in quantum chemistry, probability theory, topology and differential geometry methods form

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the basis of thermodynamics, graph theory in organic chemistry, differential equations are widely used to analyze the properties of organic molecules.
Exercise: The number of atoms in a molecule must be an integer. Let's us see the quadratic equation 12x + y = 16. For mathematics, this equation describes a straight line. This equation has an infinite number of solutions. For chemists, the expression 12x + y describes the molecular mass of a hydrocarbon

$$C_xH_y(Ar(C) = \frac{12g}{mol}; \quad Ar(H) = 1\frac{g}{mol};$$

Having a single hydrocarbon with a molecular mass of 16, the homologous alkane-methane is the first member of the homologous series, so only the equation with a single solution has the chemical meaning x = 1, y = 4.
Chemicals and physical quantities used to describe reactions can only take on non-negative values: mass, volume, concentration, reaction rate, and so on.
Exercise -1.Calculate the composition of the equilibrium mixture. A mixture of nitrogen and hydrogen in a ratio of 1: 3 was heated until equilibrium was established. Calculate which part of the starting material is converted to ammonia, if the final temperature of the mixture and the equilibrium at 100 atom is equal to 5 * 〖10〗 ^ (- 6)

Solving: We need to write reaction equations. N_2 + 3H_2 = 2NH_3. We create a table of the amount of substances before the reaction, the amount of reactants and the amount formed during the reaction. x- nitrogen fixation. The equation expressing the equilibrium concentration can then be determined by the pressure in the known mixture x:

The amount of the substances (молл)	N_2	H_2	NH_3	The whole
Initial composition	1	3	0	4
Reacted	x	3x	2x	
The final (equilibrium) composition	1-x	3-3x	2x	4-2x

$$K = \frac{{P_{NH_3}}^2}{P_{N_2}{P_{H_2}}^3} = \frac{\left(\frac{2x}{4-2x}P\right)^2}{\left(\frac{1-x}{4-2x}P\right) * \left(\frac{3-3x}{4-2x}P\right)^2} = 5 * 10^{-6}$$

P=100 This equation of the fourth degree with respect to atm and x has 4 true roots:

$$x_1 = -0{,}187; \quad x_2 = 0{,}120 \quad x_3 = 1{,}880; \quad x_4 = 2{,}187;$$

The positive state of concentrations is satisfied only by $x2$ (only one root has a chemical meaning).

Exercise-2 For complete combustion of a mixture of 1.74 g mass of methyl and ethyl alcohol consumes 2016 ml of oxygen. Determine the mass fraction of the initial mixture of each alcohol.

Given Solution:

$$M(mixture) = 1{,}74\text{г}\ \overbrace{CH_3OH}^{x} + \overbrace{1.5O_2}^{1,5x} = CO_2 + H_2O$$

$$V(O_2) = 2{,}016\text{л}\ \overbrace{C_2H_5OH}^{y} + \overbrace{3O_2}^{3y} = 2CO_2 + 3H_2O$$

need to find:

$w(CH_3OH)$—? ;*we will find:*$n(CH_3OH) = x$ моль, a; $n(C_2H_5OH) = y$ моль

$$w(C_2H_5OH)\text{—? } n(O_2) = 0.09\text{моль}$$

$$0{,}09 = 1{,}5x + 3y$$

$$\begin{cases} m(CH_3OH) = 32 \cdot x = 32x \\ m(C_2H_5OH) = 46 \cdot y = 46y \end{cases} \leftrightarrow \begin{cases} 0.09 = 1.5x + 3y \\ 1.74 = 32x + 46y \end{cases}$$

$$m(CH_3OH) + m(C_2H_5OH) = 1.74\text{г}$$

$$x = 0.04\text{моль}$$

$$y = 0.01\text{моль}$$

$$m(CH_3OH) = 32\frac{\text{г}}{\text{моль}} \cdot 0{,}04\text{моль} = 1{,}28\text{г}$$

$$w(CH_3OH) = \frac{1{,}28\text{г}}{1.74\text{г}} = 73{,}6\%$$

$$m(C_2H_5OH) = 46\frac{\text{г}}{\text{моль}} \cdot 0{,}01\text{моль} = 0{,}46\text{г}$$

$$w(C_2H_5OH) = 0{,}46\text{г}/1{,}74\text{г} = 26{,}4\%$$

Answer:$w(CH_3OH) = 73{,}6\%$; $w(C_2H_5OH) = 26{,}4\%$.

This article looks through examples which show how some mathematical concepts in chemistry can be applied.

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