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Solve Some Chemical Reactions Using Equations

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Abstract: There are difficulties in calculating some chemical reactions, which make it easier to solve such reactions by making the equation appear. Sometimes we encourage students to solve problems using ready-made formulas in percentage concentration, and in other cases using proportions.

Key words: percentage, concentration, proportion, weight, amount of substance, sulfur, percentage, oxide.

There is no need to discuss molecular weights and weight ratios from the formulas of substances, as chemistry teachers have a general idea about these calculations and the formulas for writing them. However, they do not yet have a general idea of how to solve the problems related to the concept of "interest". Sometimes we encourage students to solve problems using ready-made formulas in percentage concentration, and in other cases using proportions. The knowledge and skills that students have acquired in arithmetic in grades V and VI in calculating percentages from numbers to percentages are sufficient to solve problems related to the percentage concentrations of solutions. Therefore, the teacher should try to strengthen this concept in the memory of the students.

We consider below the solution of several problems from the percentage concentration of solutions.

Issue 1. $30\ g$ What is the concentration obtained by dissolving table salt $120\ g$ in water?

The solution to this problem is usually based on the following considerations:

1. The total weight of the solution

$$30 + 120 = 150\ g.$$

2. $100\ g$leads to the calculation of the amount of salt in solution. The following proportion is formed for this:

$150\ g$ The solution contains $30\ g$ table salt.

$100\ g$ The solution contains $x\ g$ table salt.

$$150 : 30 = 100 : x,$$

$$x = \frac{30 \cdot 100}{150} = 20\ g.$$

Hence, the concentration of the resulting solution $20\ \%$. Analyzing this form of solution in relation to the percentage concentration, we find it to be incorrect because the students have just mastered that the ratio of the amount of solute to the total amount of solution is concentration.

Instead of reinforcing the given concept while solving the problem, we encouraged the reader to use the confusing ideas mentioned above. Therefore, the solution of the problem should be in such a way that only the concepts of "concentration" and "percentage" are embodied in it. In such cases, the solution is as follows:

Issue 2. Place a cloth soaked in a 5 percent solution of baking soda on the burn site with phosphorus. $200\ g$ How many grams of soda and water should be taken to prepare such a solution?

Solution. 1. How many grams of soda should be taken to prepare a solution? $5\ \%$ becauseitformspartof solution$0{,}05$

$$200 \cdot 0{,}05 = 10\ g.$$

2. How many grams of water are needed to prepare the solution?

$$200 - 10 = 190\ g.$$

The second different option. Sea water$3{,}5\ \%$ contains salt. $10\ kg$ How much salt is left after the seawater has evaporated? The solution to this and previous problems is often expressed in the following proportions:

$100\ kg$seawater contains $3{,}5\ kg$ salt.

$10\ kg$sea salt $x\ kg$ contains salt.

$$100 : 3{,}5 = 10 : x,$$

$$x = \frac{3{,}5 \cdot 10}{100} = 0{,}35\ kg\ (350\ g).$$

This form may vaguely represent the concepts of "percentage" and "concentration". The form of writing the solution to the problem should be different, ie as follows:

$$10\ kg \cdot 0{,}035 = 0{,}35\ kg\ (350\ g).$$

Both options considered are options of the same type (as stated in the program).

In practice, there are different options for this type of solution. For example, issue 2. How much water must be dissolved in copper sulphate $10\ g$ to obtain a solution of $5\ \%$?

Solution. 1. Find the total weight of the solution . $10\ g$ Since it is 0.05 part of the solution,

$$10\ g : 0{,}05 = 200\ g.$$

2. The weight of water is equal to the difference between the weight of the solution and the weight of the copper sulphate:

$$200 - 10 = 190\ g.$$

The amount of water can be calculated in another way. Since copper sulphate in solution is water, the total weight of the solution is also calculated by finding the fraction of the number when the copper sulphate in it is known:

$$200\ g \cdot 0{,}95 = 190\ g.$$

Issue 3. How much copper sulphate must be dissolved in water to obtain a 10 per cent solution $180\ g$?

Solution. Since the solution consists only of copper sulphate and water, $180\ g$ the percentage of the solution is 90 - 0,9 and the weight of the solution

$$180\ g : 0{,}9 = 200\ g$$

it is not difficult to know that. The weight of copper sulphate is equal to the difference between the weight of the solution and the weight of the water:

$$200 - 180 = 20\ g.$$

In this case, too, the weight of copper sulphatecan be calculated in another way.

By finding the fraction of the number after determining the weight of the solution and the presence of 10 percent 0.1 part copper sulfate in the solution

$$200\ g \cdot 0{,}1 = 20\ g$$

is solved.

Issue 5. To increase the yield of some crops, a 0.2 percent copper sulphate solution is sprayed on their seeds before planting. $4\ g$ How many solutions can be prepared from copper sulphate?

Solution. $4\ g$ The amount of the whole solution is calculated by knowing that the copper sulphate is $0{,}02$ percent, i.e., part of the solution $0{,}0002$:

$$4\ g : 0{,}0002 = 20\ 000\ g\ (20\ kg).$$

Thus, the problems given to the percentage concentration of a solution can also be considered as finding the percentage of a number or the percentage of a number in terms of mathematical content.

Calculate the percentage of solutions in a chemical compound from the formula:

Issue 1. a) Determine the percentage of sulfur in SO_2 and b) SO_3.

Solution. 1. Calculate the percentage of sulfur in SO_2:

$$GM_{SO_2} = 32 + 16 \cdot 2 = 64\ g.$$

$$\frac{32}{64} = 0{,}5 = 50\ \%.$$

2. Calculate the percentage of sulfur in SO_3. This calculation is also written in the form above.

The writing form and calculation based on the following considerations do not correspond to the content of the issue:

$$64\ g\ SO_2 \text{also contains } 32\ g\ S,\ \ 100\ g \text{ of } SO_2 \text{ contains } -\ \text{x}\ g\ \text{S}$$

$$x = \frac{100 \cdot 32}{64} = 50\ g.$$

Analyzing the methods of solving problems related to calculations in the chemistry course,it is impossible not to see that they are the same (calculation from proportion or ready formula). Otherwise, students may forget to use percentages in chemical calculations.

b) Calculate from a formula the amount of product that can be obtained from a given quantity of substance.

Issue 1. $40\ g$ How many grams of iron are in iron oxide?

From the formula we find the molecular weight of iron oxide:

$$56 \cdot 2 + 16 \cdot 3 = 160.$$

Hence, one gram molecule of iron oxide $160\ g$. Then

$$56 \cdot 2 = 112\ g$$

There is iron. based on which the proportion is formed:

$$\frac{160\ g}{40\ g} = \frac{112\ g}{x}$$

henceforth

$$x = \frac{112\ g \cdot 40\ g}{160\ g} = 28\ g.$$

Answer: 28 g iron.

In our opinion, it is better to rely on the law of continuity of content in solving this type of problem. Because students repeat this law once more to solve each problem and determine that the content of the substance is constant. For example, ron oxide $160\ g, 160\ kg, 160\ m$ contains iron $112\ g, 112\ g, 112\ m$ i.e. 70 % $(112 : 160 = 0{,}7)$.

Hence, no matter how much iron oxide weighs, it contains iron 70 %.

We recommend that the calculation be carried out in a form that includes the above.

1. Calculate the percentage of iron in iron oxide:

$$\frac{112}{160} = 0{,}7 = 70\ \%.$$

2. 40 $g$find the amount of iron in iron oxide:

$$40\ g \cdot 0{,}7 = 28\ g\ \text{ iron.}$$

There may be another option for this type of issue.

The proposed form not only reveals the chemical meaning of the content of the problem, but also aims to explain to students the meaning of the law of continuity of content, to develop their logical consciousness.

Calculate from the reaction equation how much you need to get from the starting material to get the required amount of substance and vice versa. It is impossible to ignore the existing methods of solving this type of problem.

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