New types of problems and their solutions on the subject of the theory of electolitic dissociation

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ABSTRACT

This article is intended to strengthen the knowledge of students of chemistry and their ability to work on problems in chemistry. The article introduces some new types of problems related to the topic of electrolytic dissociation and their solutions, which will help to further develop the thinking skills of the learners and make them study the subject more solidly.

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I.Introduction

Chemistry is one of the natural sciences that studies the evolution of substances, their properties, and various processes. This science is connected with biology, geography, history, geology, physics, mathematics and many other sciences, among which mathematics has a special place. Because there are problems with a lot of chemistry, and math helps us do that.

The literature covers the following types of issues:

1. If 90 out of every 150 molecules of an electrolyte are ionized, what is the percentage of dissociation?

2. Determine the degree of dissociation of the acid when the concentration of hydrogen ions in a 0.1 molar solution of cyanic acid is 6 • 10-3 mol / l.

3. 200 ml of 0.2 M bromide with a dissociation rate of 90% 18. How many milliliters of cation in an acid solution?

4. Find the dissociation constant of acetic acid if the dissociation rate of a 0.002 M solution of CH3COOH is 9.4%?

Below we discuss new types of problems and their solutions on the topic of "Theory of Electrolytic Dissociation".

1 - problem.

Find the number of electrons in the cations formed by the dissociation of 120 molecules of the salt K2SO4? ($\alpha = 100\%$)

Solution.

Under the conditions of the problem, we first write the equation of the dissociation reaction of the potassium sulfate salt.

$$K_2SO_4 \rightleftharpoons 2K^+ + SO_4^{2-} \quad (1)$$

Now we need to find out how many cations are formed in order to solve the problem. According to the reaction equation, two potassium cations are formed from one molecule of potassium sulfate. Knowing that all 120 molecules given in the problem condition break down into ions (α = 100%), we can determine the proportion of how many cations are formed from them:

$$1 \text{ ——— } 2 \text{ kation}$$
$$120 \text{ ——— } x = 240 \text{ kation} \qquad x = \frac{120 \times 2}{1} = 240$$

This means that 240 potassium cations are formed.

Now we need to find the number of electrons. To do this, we first find how many electrons are in one potassium cation. A potassium atom has 19 electrons. When potassium is in the cation state, it donates one electron to the sulfate anion. Therefore, one potassium cation contains 18 electrons. Find the number of electrons in the 240 cations formed by dissociation.

240 x 18 = 4320 electrons

This means that the cations formed by the dissociation of 120 molecules contain 4320 electrons.

The same thing applies with anions.

2 – problem.

Find the number of electrons in the anions formed by the dissociation of 120 molecules of the salt K2SO4? (α = 100%)

Solution.

According to (1), one sulphate anion is formed from one molecule and 120 anions from 120.

We calculate the number of electrons in the sulfate anion. SO4 contains 48 electrons and SO42- contains 50 electrons because it receives one electron from two potassium.

So 120 anions contain 120 x 50 = 6000 electrons.

3 – problem.

Find the number of electrons in the cations formed by the dissociation of 300 molecules of the salt Al2(SO4)3? (α = 60%)

Solution.

We write the dissociation reaction equation of the aluminum sulfate salt.

$$Al_2(SO_4)_3 \rightleftharpoons 2Al^{3+} + 3SO_4^{2-} (2)$$

Since the dissociation rate of a salt is 60%, we can find how many of the 300 molecules dissociate:

300 x 0,6 = 180 (3)

According to the reaction equation, two cations are formed from one molecule. From 180 molecules, 180 x 2 = 360 cations are formed.

Knowing that there are 10 electrons in one aluminum cation, we can find how many electrons there are in 360 cations:

360 x 10 = 3600 electrons

This means that the cations formed from 300 molecules of the aluminum sulfate salt with a dissociation rate of 60% contain 3600 electrons.

The same thing applies with anions.

4 – problem.

Al2(SO4)3 find the number of electrons in the anions formed by the dissociation of 300 molecules of the salt? (α = 60%)

Solution.

According to (2), three sulphate anions are formed from one molecule, while 540 sulphate anions are formed from 180 molecules.

Knowing that one sulfate anion contains 50 electrons, we find how many electrons there are in 540 anions:

540 x 50 = 27000 electrons.

This means that the anions formed from 300 molecules of the aluminum sulfate salt with a dissociation rate of 60% contain 27000 electrons.

5 – problem.

Cu(NO3)2 find the number of non-dissociated molecules if the dissociation of the salt results in the formation of cations with a total sum of 8100 electrons? (α = 75%)

Solution.

We write the dissociation reaction equation of the copper (II) nitrate salt.

$$Cu(NO_3)_2 \rightleftharpoons Cu^{2+} + 2NO_3^- \quad (4)$$

One copper cation contains 27 electrons because it donates two electrons. Find the number of cations in 8100 electrons:

$$\frac{8100}{27} = 300$$

So 300 cations were formed. According to (4), one cation is formed from one molecule. Accordingly, there are 300 dissociated molecules. Using the degree of dissociation, we find the number of non-dissociated molecules:

If the dissociated molecules are 75%, the number of non-dissociated molecules (100 - 75 = 25) is 25%.

$$\begin{array}{l} 75\ \% \quad \text{————} \quad 300 \\ 25\ \% \quad \text{————} \quad x = 100 \end{array} \qquad x = \frac{25 \times 300}{75} = 100$$

This means that the number of undissociated molecules is 100.

6 – problem.

Cu(NO3)2 find the number of non-dissociated molecules if the dissociation of the salt resulted in the formation of anions with a total sum of 16000 electrons? (α = 83,33%)

Solution.

The nitrate anion contains 32 electrons because it binds one electron. 16000 electrons are contained in 500 (16000/32) anions. According to (4), if two anions are formed from one molecule, 500 anions are formed from 250 molecules. If they are 83,33%, undissociated molecules are 16,67%. (100 - 83,33 = 16,67)

Now we find the number of non-dissociated molecules:

$$\begin{array}{l} 83{,}33\ \% \quad \text{————} \quad 250 \\ 16{,}67\ \% \quad \text{————} \quad x = 50 \end{array} \qquad x = \frac{16{,}67 \times 250}{83{,}33} = 50$$

This means that the number of undissociated molecules is 50.

I believe that such issues will help to broaden the horizons of students of chemistry and to understand the issues of dissociation constant, degree of dissociation. This will increase the effectiveness of the subject and improve the quality of education.

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