



METHODS OF SOLVING ISSUES IN WHICH THE LEVEL OF COMPLEXITY IS HIGHER THAN IN SELF-EDUCATION

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Abstract

This article presents methods for solving problems for "Mixture of metals", "Mixture of gases", "Solutions" and "Mixtures of organic substances" in the process of continuous education.

Key words: continuous learning process, educational value of solving problems in chemistry, tasks in chemistry of increased complexity, methods for solving problems related to mixtures.

In accordance with the decisions of the president of the Republic of Uzbekistan on August 12, 2020 PQ-4805 "on measures to improve the quality of Continuing Education and the productivity of Science in the areas of Chemistry and biology", it is relevant to generate practical comets in them by applying the theoretical knowledge received by students in continuing education. It is worth noting that general secondary education in the process of continuing education is one of the main tasks of a chemistry teacher in schools and academic lyceums, teaching students to solve issues with a high level of complexity based on theoretical knowledge gained from chemistry.

Due to this, the educational significance of problem solving in the teaching of chemistry is that in the process of solving problems, chemical concepts about substances and processes are strengthened and improved, a solid acquisition of knowledge occurs[1;64].

Solving chemical issues connects living with production, labor education skills are formed, directing the acquisition of a specialty, and cross-subject communication in mathematics and Physical Sciences is realized.

By solving the problem, students understand the content and essence of their acquired theoretical knowledge, learn to think logically, allow the formation of personal qualities such as confidence in their own strength and knowledge[2;67].

In the classes of general secondary schools and academic lyceums, where chemistry is taught in depth, the level of complexity from chemistry has to be solved with a slightly higher level of complexity. In particular, when preparing students who have chosen a chemical specialty for admission to higher education institutions,



conducting extracurricular classes in chemistry in secondary schools, preparing students for district, city, regional and Republican Science Olympiads, it becomes necessary to study methods of solving issues with a high degree of complexity.

Solving problems with a high degree of complexity in chemistry in the process of continuing education requires the teacher to take into account the knowledge of students, to quickly make a logical reasoning on the issue in any situation, to find a logical connection. Through methods close to the reader, it is necessary to solve the issue in the shortest possible ways.

We want to propose “algebraic methods for solving problems in mixtures” on several topics with a slightly higher level of complexity, which can be solved with students in the process of continuing education.

The issue of mixtures of metals

Issue 1. When a mixture of zinc with 2.33 g of iron was dissolved in acid, 896 ml of hydrogen was released. Determine the composition of the mixture.

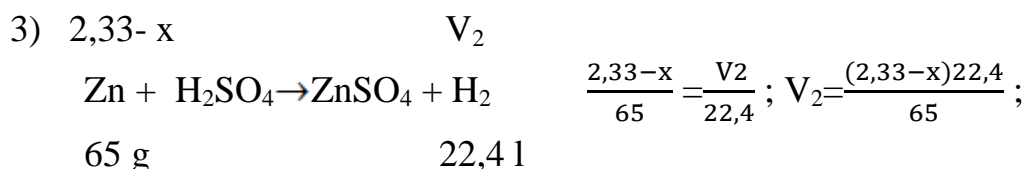
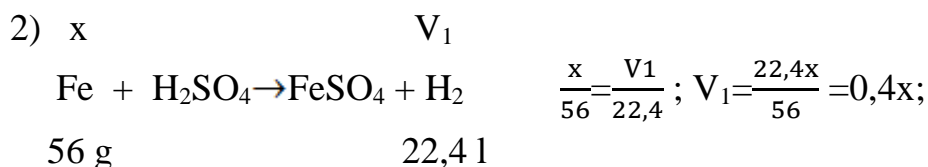
Given: $m(\text{Fe}+\text{Zn})=2.33 \text{ g}$;

$V(\text{H}_2)=896\text{ml}=0.896 \text{ l}$; $n(\text{H}_2)=0.896/22.4=0.04 \text{ mol}$; $A_r(\text{Fe}) = 56$; $A_r(\text{Zn})=65$;

Need to find: $m(\text{Fe})=?$; $m(\text{Zn})=?$

Constructing an algebraic equation with one unknown:

1) $m(\text{Fe})=x$; $m(\text{Zn})=2,33-x$ bilan belgilaymiz;



4) we construct an unknown equation :

$0.4 x + (2,33-x) 22,4 / 65 = 0,896$ and solve it : $0.4 x + (2,33-x) 0,345 = 0,896$; $0.4 x + 0,8038 - 0,345 x = 0,896$;

$0.055 x = 0.0922$; $x = 1.676 \text{ g Fe}$; $m(\text{Zn}) = 2.33 - 1.68 = 0.65 \text{ g}$.

A: the mixture contained 1.68 g of iron and 0.65 g of zinc.

If mass shares are asked $\omega(\text{Fe}) = 1.68/2.33 \cdot 100 = 72.1 \%$;



$$\omega(\text{Zn}) = 0.65 / 2.33100 = 27.89 \% [4; 128-129].$$

Issues of mixtures of gases

Issue 1. The density of a mixture of gases consisting of oxygen and ozone compared to hydrogen is 16.4. Calculate the volumetric shares of gases in the mixture.

Given: $D(\text{H}_2) = 16.4$; $M(\text{O}_2) = 32 \text{ g/mol}$; $M(\text{O}_3) = 48 \text{ g/mol}$;

Need to find:

$$\varphi(\text{O}_2) = ?$$

$$\varphi(\text{O}_3) = ?$$

Solution: 1. We calculate the average molecular mass of the mixture: $M(\text{med}) = 2 * D(\text{H}_2) = 2 * 16.4 = 32.8$;

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2. We construct an equation and solve it: $32x + 48(1-x) = 32.8$; $32x + 48 - 48x = 32.8$;

$$16x = 15.2; x = 0.95 \text{ or } 95\% \text{ oxygen.}$$

3. $\varphi(\text{O}_2) = 0.95$ or 95 %; $\varphi(\text{O}_3) = 0.05$ or 5 %.

This means that the mixture contained 95% oxygen and 5% ozone.

Issue 2. Find the volume (l) of each gas in a mixture of 8 l CO_2 and SO_2 gases with a density of 25 relative to hydrogen.

Given: $D(\text{H}_2) = 25$; $M(\text{CO}_2) = 44 \text{ g/mol}$; $M(\text{SO}_2) = 64 \text{ g/mol}$; $V(\text{mixture}) = 8 \text{ L}$;

Need to find: $V(\text{CO}_2) = ?$ $V(\text{SO}_2) = ?$

Solution: 1. We calculate the average molecular mass of the mixture:

$$M(\text{med}) = 2 * D(\text{H}_2) = 2 * 25 = 50;$$

2. If you make an equation and solve it: $44x + 64(1-x) = 50$; $44x + 64 - 64x = 50$;

$20x = 14$; $x = 0.7$ is the volumetric share of CO_2 , and the volumetric share of SO_2 is

0.3. Hence, the mixture contains $V(\text{CO}_2) = \varphi(\text{CO}_2) * V(\text{mixture}) = 0.7 * 8 = 5.6 \text{ l}$;

$$V(\text{SO}_2) = \varphi(\text{SO}_2) * V(\text{mixture}) = 0.3 * 8 = 2.4 \text{ l.}$$

If the masses of the gases are desired, $m(\text{SO}_2) = \varphi(\text{SO}_2) * M(\text{SO}_2) = 0.3 * 64 = 19.2$;

$$m(\text{CO}_2) = \varphi(\text{CO}_2) * M(\text{CO}_2) = 0.7 * 44 = 30.8;$$

If mass shares of gases are desired, $\omega(\text{SO}_2) = 19.2 / 50 = 0.384$ or 38.4 %; $\omega(\text{CO}_2) = 30.8 / 50 = 0.616$ or 61.6%.

Solving issues related to solutions

Issue 1. If a solution of 205.2 g of aluminum sulfate contains 66.22 10²⁴ protons, find the mass fraction of salt in the solution.

Given: $m(\text{Al}_2(\text{SO}_4)_3 \text{ solution}) = 205.2 \text{ g}$; $N(\text{proton}) = 66.22 \cdot 10^{24}$;

$M(\text{Al}_2(\text{SO}_4)_3) = 342 \text{ g/mol}$; $M(\text{Water}) = 18 \text{ g/mol}$;

Need to find: $\omega(\text{Al}_2(\text{SO}_4)_3) = ?$



Solution: 1. we determine the number of protons contained in $\text{Al}_2(\text{SO}_4)_3$:
 $26+48+96=170$;

2. And the protons in H_2O are $2+8=10$;

3. Using the given and found values, we construct a system of equations and solve

it:
$$\begin{cases} 342x + 18y = 205,2 \\ 170x + 10y = 110 \end{cases}$$
 We multiply Equation 2 by 1.8, resulting in

$$\begin{cases} 342x + 18y = 205,2 \\ 306x + 18y = 198 \end{cases}$$

$36x = 7.2$; $x = 0.2$ mol is the quantity of $\text{Al}_2(\text{SO}_4)_3$, using which we determine the mass: $m(\text{Al}_2(\text{SO}_4)_3) = 0.2 \cdot 342 = 68.4$ g;

4. Mass fraction of salt in solution :

$$\omega(\text{Al}_2(\text{SO}_4)_3) = 68,4 / 205,2 \cdot 100 = 33,33 \%$$

Issue 2. Calculate the mass fraction(%) of the anhydrous salt in the solvent formed when 114.8 g of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ crystalhydrate is dissolved in 85.2 g of water.

Given: $m(\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}) = 114.8$ g; $m(\text{Water}) = 85.2$ g;

Need to find: $\omega(\text{ZnSO}_4) = ?$;

Solution: 1. $M(\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}) = 161 + 126 = 287$ g/mol;

2. 287 g $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ ----- 161 g has ZnSO_4 ;

114.8 g $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ ----- x g has ZnSO_4 . $x = 64.4$ g .

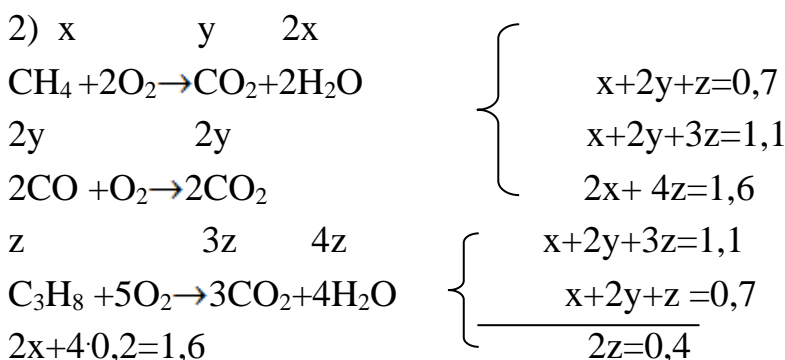
3. $M = 114.8 + 85.2 = 200$ g ;

4. $\omega(\text{ZnSO}_4) = 64,4 / 200 \cdot 100\% = 32,2\%$. [6;12].

Mixtures of organic matter

Example 1. 15.68 l (consisting of CH_4 , CO and C_3H_8 n.sh.) when the mixture was burned, 48.4 g of CO_2 and 28.8 g of H_2O were formed. The substances contained in the initial mixture (ber-tart.) determine the mole ratio.

Solution: 1) $n(\text{ar}) = 15.68 / 22.4 = 0.7$ mol $n(\text{CO}_2) = 48.4 / 44 = 1.1$ mol; $n(\text{H}_2\text{O}) = 28.8 / 18 = 1.6$ mol





$$2x+0,8=1,6$$

$$z=0,2 \text{ mol propan}$$

$$2x=0,8$$

$$x=0,4 \text{ mol metan}$$

$$0,4+2y+0,2=0,7$$

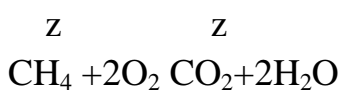
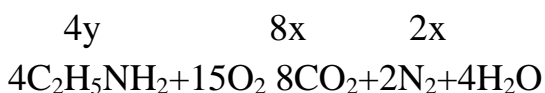
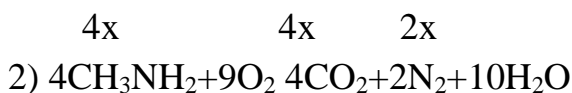
$$2y=0,1 \text{ is gazi}$$

$$y=0,05 \text{ mol}$$

$$0,4:0,1:0,2=4:1:2 \quad \text{Anser: } 4:1:2$$

Example 2. 17.92 l (consisting of methylamine, ethylamine and methane n.sh.) when the mixture is burned 6.72 l (. n.sh.) nitrogen 22.4 l (. n.sh.) CO₂ was formed. Determine the volumetric shares (%) of gases in the initial mixture.

Solution: 1) $n(\text{ar.})=17.92/22.4=0.8 \text{ mol}$ $n(\text{N}_2)=6.72/22.4=0.3 \text{ mol}$; $n(\text{CO}_2)=1 \text{ mol}$



$$3) \left. \begin{array}{l} 4x+4y+z=0,8 \\ 4x+8y+z=1 \\ 2x+2y=0,3 \end{array} \right\} \begin{array}{l} 4x+8y+z=1 \\ 4x+4y+z=0,8 \\ 4y=0,2 \text{ mol etilamin} \end{array}$$

$$2x+2 \cdot 0,2=0,3$$

$$2x=0,2 \quad \quad \quad 4 \cdot 0,1+0,2+z=0,8$$

$$x=0,1 \quad \quad \quad 0,4+0,2+z=0,8$$

$$4x=4 \cdot 0,1=0.4 \text{ mol methylamine} \quad z=0.2 \text{ mol methane}$$

$$4) V(\text{methylamine})=0.4 \cdot 22.4=8.96$$

$$V(\text{ethylamine})=0.2 \cdot 22.4=4.48$$

$$V(\text{methane})=0.2 \cdot 22.4=4.48$$

$$\varphi(\text{methylamine})=8,96/17,92 \cdot 100=50\%$$

$$\varphi(\text{ethylamine})=4,48/17,92 \cdot 100=25\%$$

$$\varphi(\text{methane})=4,48/17,92 \cdot 100=25\%.[2;137-138].$$

Teaching students to solve an issue from chemistry in several ways causes the teacher's skills to increase even more due to the fact that he requires the teacher to constantly work and seek on himself.

It allows practical competencies to be formed in students due to the use of the theoretical knowledge they receive in the performance of practical exercises.



References

1. Rakhmatullayev N., Omonov H., Mirkomilov Sh. Methodology of teaching chemistry. - Tashkent.: Economics-Finance, 2013. – 320 b.
2. I.A.Asqarov, M.A.Bahodirova. Question and answer from chemistry, issue and their solutions. Tashkent.: Publishing-Press creative house named after Fafur Fulom, 2014. – 379 B.
- 3.A.G.Muftakhov. Olympic issues and their solutions from organic chemistry. Tashkent.: Teacher, 1997. – 222 B.
- 4.D.P.Erigin, E.A.Shishkin methodology resheniya zadach po ximii. - Moscow: "Prosvetshenie", 1989-p. 172.
5. Glinka N.L. Zadachi I uprajneniya po obtshey ximii. M.Integral-Press.2006
- 6.Jumanov A.M., Rachmatullaeva G.M., Sidikov D. Methods of solving problems with solutions (methodological manual). Fergana publishing, 2005. – 52.
7. Kazimova N. Meliboeva G., Jumanov A.Dependence On The Professional Competence Of The Organizers Of Educational Processes. 2023, Vol. 7, No. 4, pp.1219-1223.
8. Jumanov A., Mexmonova R.Use of Didactic Games in Teaching Chemistry. Table of Content - Vol 2 No 5 May 2023 pp.123-127.