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«Жанармай, катализ және электрохимия институты» АҚ

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EFFECTIVE TECHNOLOGY OF TEACHING "SALTS HYDROLYSIS" IN CHEMISTRY

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Abstract. The secondary education system is constantly changing and renewing. The implementation of a renewed educational programme to develop students' critical thinking, self-reflection and in-depth analysis of information depends on the quality of the teacher's work. The effective use of technology in the classroom is a major issue today. A creative level of learning is defined by the actions of students in their own search for knowledge, skills and abilities; a creative level of learning is achieved. As a result of engaging students in independent creative activities, heuristic ways of inquiry become possible. As a result of the ways of thinking that provide this level of knowledge; they are also involved in creative activities: students identify topics and tasks, work actively, formulate hypotheses and research plans, and carry out research activities. In order to meet these challenges, it is appropriate to teach using the technology of the three-dimensional methodological system (TTMS). This article looks at the planning and teaching of the topic "Hydrolysis of salts" in chemistry using one of the new TTMS technologies. The aim of the article is to independently form and measure the level of development of functional literacy of students within the framework of the above mentioned technology; to determine the quality of student's knowledge in the subject

based on the results of criterion-based assessment. Before the new topic is explained to the students, they are given the opportunity to master it on their own. To do this, the pupils first prepare themselves by completing the "anchor tasks" at home. This develops their ability to work with the textbook and search independently, increasing the quality of their knowledge. The third stage (feedback) is the completion of three (four) levels of tasks. The first three levels constitute the compulsory level of the state standard: while the first level tasks cover the maximum required minimum of the state standard level, the next two levels are devoted to the in-depth development of this knowledge by students, systematically summarising the results. The fourth creative level tasks (Olympiad assignments, research projects) are independently compiled by teachers, depending on the abilities of the individual child.

Keywords: qualitative knowledge, functional literacy, hydrolysis of salts, ionic product, degree of hydrolysis

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ХИМИЯДАН "ТҰЗДАР ГИДРОЛИЗІ" ТАҚЫРЫБЫН ОҚЫТУДЫҢ ТИІМДІ ТЕХНОЛОГИЯСЫ

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Аннотация. Орта білім беру жүйесі үнемі өзгеріп, жаңарып отырады. Оқушылардың сыни ойлауын, өзіндік рефлексиясын және ақпаратты терең талдауды дамыту бойынша жаңартылған білім беру бағдарламасын іске асыру оқытушының жұмыс сапасына байланысты. Технологияны сыныпта тиімді пайдалану бүгінгі күні маңызды мәселе болып табылады. Оқытудың шығармашылық деңгейі оқушылардың білімін, дағдылары мен дағдыларын іздеудегі іс-әрекеттерімен анықталады; оқытудың шығармашылық деңгейіне қол

жеткізіледі. Студенттерді тәуелсіз шығармашылық қызметке тарту нәтижесінде зерттеудің эвристикалық әдістері мүмкін болады. Білімнің осы деңгейін қамтамасыз ететін ойлау тәсілінің нәтижесінде олар шығармашылық қызметке де қатысады: оқушылар тақырыптар мен міндеттерді анықтайды, белсенді жұмыс істейді, гипотезалар мен зерттеу жоспарларын тұжырымдайды және зерттеу қызметін жүзеге асырады. Осы мәселелерді шешу үшін үш өлшемді әдістемелік жүйе (ҮӨӘЖ) технологиясын қолдана отырып оқытуды жүргізген жөн. Бұл мақалада жаңа ҮӨӘЖ технологиясын қолдана отырып, химия бойынша "Тұз гидролизі" тақырыбын жоспарлау және оқыту қарастырылады. Мақаланың мақсаты жоғарыда аталған технология шеңберінде оқушылардың функционалдық сауаттылығының даму деңгейін дербес қалыптастыру және өлшеу; критериалды бағалау нәтижелері негізінде оқушылардың пән бойынша білім сапасын анықтау болып табылады. Студенттерге жаңа тақырыпты түсіндірмес бұрын, оларға оны өз бетінше игеруге мүмкіндік беріледі. Мұны істеу үшін оқушылар алдымен үйде "тірек тапсырмаларын" орындау арқылы өздерін дайындайды. Бұл олардың оқулықпен жұмыс істеу және өз бетінше іздеу қабілетін дамытады, олардың білім сапасын арттырады. Үшінші кезең (кері байланыс) — тапсырмалардың үш (төрт) деңгейін орындау. Алғашқы үш деңгей мемлекеттік стандарттың міндетті деңгейін құрайды: бірінші деңгейдегі тапсырмалар Мемлекеттік стандарттың ең қажетті ең төменгі деңгейін қамтыса, келесі екі деңгей нәтижелерді жүйелі түрде қорытындылай отырып, оқушылардың осы білімді терең игеруіне арналған. Төртінші шығармашылық деңгейдегі тапсырмаларды (олимпиадалық тапсырмалар, зерттеу жобалары) мұғалімдер нақты баланың қабілетіне қарай дербес құрастырады.

Түйін сөздер: сапалы білім, функционалдық сауаттылық, тұз гидролизі, иондық өнім, гидролиз дәрежесі

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ЭФФЕКТИВНАЯ ТЕХНОЛОГИЯ ПРЕПОДАВАНИЯ ТЕМЫ "ГИДРОЛИЗ СОЛЕЙ" ПО ХИМИИ

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Аннотация. Система среднего образования постоянно меняется и обновляется. Реализация обновленной образовательной программы по развитию критического мышления учащихся, саморефлексии и углубленного анализа информации зависит от качества работы преподавателя. Эффективное использование технологий в классе сегодня является серьезной проблемой. Творческий уровень обучения определяется действиями учащихся в их собственном поиске знаний, навыков и умений; достигается творческий уровень обучения. В результате вовлечения студентов в самостоятельную творческую деятельность становятся возможными эвристические способы исследования. В результате образа мышления, обеспечивающего такой уровень знаний, они также вовлекаются в творческую деятельность: учащиеся определяют темы и задачи, активно работают, формулируют гипотезы и исследовательские планы, а также осуществляют исследовательскую деятельность. Для решения этих задач целесообразно проводить обучение с использованием технологии трехмерной методической системы (TTMS). В этой статье рассматривается планирование и преподавание темы "Гидролиз солей" по химии с использованием технологий TTMS. Целью статьи является самостоятельное формирование и измерение уровня развития функциональной грамотности учащихся в рамках вышеуказанной технологии; определение качества знаний учащихся по предмету на основе результатов критериального оценивания. Прежде чем студентам объяснять новую тему, им предоставляется возможность освоить ее самостоятельно. Чтобы сделать это, ученики сначала подготавливают себя, выполняя "опорные задания" дома. Это развивает у них способность работать с учебником и осуществлять самостоятельный поиск, повышая качество их знаний. Третий этап (обратная связь) — это выполнение трех (четырех) уровней заданий. Первые три уровня составляют обязательный уровень государственного стандарта: в то время как задания первого уровня охватывают максимально необходимый минимум уровня государственного стандарта, следующие два уровня посвящены углубленному освоению учащимися этих знаний с систематическим обобщением результатов. Задания четвертого творческого уровня (олимпиадные задания, исследовательские проекты) составляются учителями самостоятельно, в зависимости от способностей конкретного ребенка.

Ключевые слова: качественные знания, функциональная грамотность, гидролиз солей, ионный продукт, степень гидролиза

Introduction

The secondary education system is changing radically. The implementation of the updated educational program for the formation of students' skills of constructive thinking, self-search and deep analysis of information depends on the quality of the teacher's activity (Karaev, 2018).

The main point of the topic under study is to improve the quality of Education. The goals and objectives of the topic are dictated by the needs of the education system today. Society has changed. Accordingly, the economy has also changed. The change requires a high level of professional quality of its participants. The education sector plays a key role in solving these complex problems. For this purpose, it is urgent to meet the needs of society for young people who can work in any situation, see problems and turn them into tasks, create technologies, methods of solving and make decisions, have high-quality knowledge of Information Technologies.

The quality of education is determined in the world by International Studies (PISA, TIMSS, PIRLS). These studies are conducted on the basis of a unique selection of students and allow conclusions to be drawn about the overall quality of the system. Based on the results of these studies, we know that it is necessary to improve the natural science literacy of 15-year-old Kazakh schoolchildren.

Criterion-based assessment determines the goal of creating conditions and opportunities for educational and cognitive activity, formation and development of students, their creative and search-cognitive "immersion in the learning environment", orientation, the flow of scientific information through the involvement of students leads to systematic reflection, search for the meaning of this activity.

Current criterion-based assessment (formative assessment) determines the current level of knowledge and skills acquisition thematic independent work, consisting of levels corresponding to the goals of training, performs tasks. It stimulates the student to understand how successfully the tasks in learning are performed, which is an independent cognitive activity and allows him to do so. For students who have not achieved the educational goal, an individual schedule is planned during the study of the topic, corrective work is carried out.

The final (summary) assessment is carried out by the teacher, determining the level after the end of each quarter. After completing the training, sections of the educational material for the quarter of knowledge, skills and application of skills are analyzed.

Assessment of determining the level of application of knowledge,skills and abilities in the conclusion aims to form functional literacy of students.

Experimental

The process of mastering the topic" hydrolysis of salts "on the SPP of pedagogical technology" three-dimensional methodological system " includes two parts.

Of the organizational part of the lesson: a) organizes the lesson in 7–8 minutes; B) checks the implementation of level tasks assigned to completion at home; C) checks first from individual students, and then from the front.

A distinctive feature of the pedagogical technology" three-dimensional methodological system " from others is that the synectic part consists of two stages.

At the first stage of the synectic part, students perform tasks necessary to independently master a new topic. He said, "Remind me! «Starts with the heading. Tasks for updating the topic improve the quality of knowledge, forming students' skills of working with textbooks and self-search.

Let me remind you! Students prepare at home for topical issues that are the basis for mastering the topic. Teamwork.

At the second stage of the synectic part, students prepare the first four of the six steps of the text in the textbook, analyze the tasks "knowledge", "understanding", "analysis", "compilation" from home and analyze them in the course of group work. The peculiarity of this is that time is saved for practical work in the classroom.

Let me remind you!

1. What is the Ionic Product Of Water? Answer: using the law of interaction of masses, we write the dissociation constant of water:

$$Kd = \frac{[H^+][OH^-]}{H_2O}$$

Since water is a very weak electrolyte, by subtracting the constant values to the right of the Equality-Kd · $[H_2O]$ = Kc we get the ionic multiplication of water.

$$Kc = [H^+]\cdot[OH^-] \text{ or } Kc = [H^+]\cdot[OH^-] = 10^{-14}$$

Is denoted as the ionic product of water and denoted as KS.

1. What is the hydrogen index? Answer: for the convenience of calculations, the hydrogen reading is expressed by PH and measured in MOL/L. Equal to the negative decimal logarithm of hydrogen ions: it indicates the concentration of hydrogen ions in their solutions.

$$pH = - \lg[H^+] \text{ or } pOH = - \lg[OH^-] \text{so, } pH + pOH = 14.$$

From this

1) if pH = 7, then the medium is neutral, here $[H^+] = [OH^-]$;

2) if pH > 7, then the medium is neutral, here $[OH^-] > [H^+]$;

3) if pH < 7, then the medium is neutral, here $[H^+] > [OH^-]$.

Students, in our lesson today we will consider "hydrolysis of salts:

The first step is to prepare students from home for the tasks of the "Know" approach.

1) What reaction is called hydrolysis? Answer: salts react with water and enter into an exchange reaction, called hydrolysis.

2) What is the concept and what concept does the term hydrolysis give? Answer: Greek"Hydro" means water, "lysos"means loss.

3) What definition would you give to the hydrolysis and constant of salts? Answer: the frequency of hydrolysis directly depends on the degree of hydrolysis (hhydr).

4) What is full hydrolysis? Answer: hydrolysis is a reversible process, but in some cases it can also occur irreversibly. Such cases:

a) when the Cation charge of the salt is large (+4, +5);

b) when both the Saltcathion and the anion are hydrolyzed simultaneously;

c) when the substance does not belong to a salt, but consists of two non-metals or a combination of an active metal and a non-metal.

Step 2 (teamwork) – tasks of approaches to "understanding" in theory. It is set in order to deepen the tasks of the *"knowledge"* approach of students in the first step. *Determine the cause.*

1) Why does a chemical reaction occur between salt and water? *Answer:* for example, explain the dissolution of sodium carbonate Na_2CO_3 in water [5-8].

$$2Na^+ + CO_3^{2-} + HOH \leftrightarrow HCO_3^- + 2Na^+ + OH^- + H^+$$

The anion of a *salt* formed by a *weak* acid binds to a hydrogen ion (H+), resulting in the formation of a weak electrolyte (HCO_3^-) *–bicarbonate* ion, and the *exchange* reaction between salt and water occurs *to the end.*

The following salts are given: KCl, $MgCO_3$, Na_2SO_3, $BaBr_2$, $Ca(NO_3)_2$,Li_2SO_4, $Fe(HSO_4)_3$, $NaNO_3$, $CuCl_2$, $FeSO_4$. Complete the following and prove your answers by writing the reaction equations.

Questions	Answers
Which salt solution indicates a neutral environment?	KCl, $BaBr_2$, $Ca(NO_3)_2$, Li_2SO_4, $NaNO_3$
Which salt solution indicates an alkaline environment?	$MgCO_3$, Na_2SO_3
Which salt solution reflects the acidic environment?	$Fe(HSO_4)_3$,$CuCl_2$, $FeSO_4$

Step 3 (group work) – tasks of approaches *"analysis"* in theory.

Compare the degree and constant of hydrolysis of salts and acid strength.

The weaker the acid (the lower the Ka-acid strength value), the stronger the hydrolysis occurs.It can also be seen in this.By Cation, the hydrolysis of the weak base by Cation $Kh = K_c/Kb$, and by anion $K_h = K_w/K_aK_b$, and the degree of hydrolysis of $h=C_h/C$ can be multiplied.

Dissimilarity: very similar to Ostwald's law of dilution.

Feature: because $K_{HCN} = 7{,}210^{-10}$ $K_h = 10^{-14}/7{,}210^{-10}$ hydrolysis takes place deep.

4. *The main idea of the topic – What is the similarity and specificity?*

The *depth* of hydrolysis of salts is quantitatively characterized by the *degree* of hydrolysis of salts ($h_г$) and the *constant* of hydrolysis (Кг). Compared to the degree of hydrolysis, the hydrolysis *constant* does not depend on the *concentration* of the solution in Кг, so it is an acceptable characteristic of this process. Kr-the value depends on the *nature* of the hydrolyzed salt and the *temperature* of the solution.

Step 4 (group work) – tasks of approaches to *"accumulation"* in theory. Stock up on what you know!

Report. Calculate the degree and constant of hydrolysis at the first stage of a solution of potassium phosphate (K_3PO_4) with a concentration of 0,1mol/l.

Resolution:

1) determination of the hydrolysis constant of the first stage is determined by the third stage (from the reference table $K_{hydro}H_3PO_4 = 4{,}2 \cdot 10^{-13}$) (Bengoetxea, 2015).

2) $h_{firsthydro}$ we'll figure it out by step.

$$2h_{hydro} = \sqrt{\frac{K_{H_2O}}{K_{acid} \cdot C_{salt}}} = \sqrt{\frac{10^{-14}}{4{,}2 \cdot 10^{-13} \cdot 0{,}1}} = \sqrt{\frac{10^{-14}}{4{,}2 \cdot 10^{-14}}} \approx 0{,}49$$

$$or\ 0{,}49 \cdot 100 = 49\%$$

The fifth step (group work) – according to the tasks of the approaches *"accumulation"* in theory, the operations *"apply"* and *"evaluate"* on the content of the topic are performed.

Report. Determine the hydrolysis constant and degree in ammonium nitrate solution with a concentration of 0.03 mol/l.

Resolution:

We determine the hydrolysis constant:

$$K_{hydro} = \frac{K_{H_2O}}{K_{OCH}} = \frac{10^{-14}}{1{,}76 \cdot 10^{-5}} = \frac{10 \cdot 10^{-15}}{1{,}76 \cdot 10^{-5}} = \approx 6 \cdot 10^{-10}$$

We determine the degree of hydrolysis of NH_4NO_3 by the formula:

$$8h_{hydro} = \sqrt{\frac{K_{H_2O}}{K_{NH_4OH} * C_{acid}}} = \sqrt{\frac{10^{-14}}{1{,}76 * 10^{-5} * 0{,}03}} \approx \sqrt{2 \cdot 10^{-8}} \approx 1{,}4 \cdot 10^{-4}$$

The sixth step (teamwork) is the tasks of the approach "evaluation" in theory.In your opinion!

Task. What would you rate the given chemical reactions below? Evaluate the hydrolysis reaction by comparison.

First example:

$$NaCI + HOH \leftrightarrow NaOH + HCI;$$
$$Na+ + CI^- + HOH \leftrightarrow Na^+ + CI^-$$
$$HOH \leftrightarrow H^+ + OH^-$$

Since the table salt solution is formed by a strong base and a strong acid, the concentration of hydrogen (H^+) and hydroxyl (OH^-) ions in the solution does not change.

Second example:

$$Na_2CO_3 + HOH = NaHCO_3 + KOH$$
$$2K^+ + CO_3^{2-} + HOH \leftrightarrow Na^+ + HCO_3^- + Na^+ + OH^-$$
$$CO_3^{2-} + HOH \leftrightarrow HCO_3 + OH^-$$

The concentration of hydroxide ions accumulates in the solution and hydrolysis occurs.

Third example:

$$ZnCI_2 \rightarrow Zn^{2+} + 2CI^-$$

$$HOH \leftrightarrow H^+ + OH^-$$
$$Zn^{2+} + HOH \leftrightarrow (ZnOH)^+ + H^+$$

The *concentration of hydrogen sulfide ions* accumulates in the solution and hydrolysis occurs.

Fourth example:

$$Al_2S_3 + 6H_2O = 2Al(OH)_3\downarrow + 3H_2S\uparrow$$

I think so! If we compare the four examples given above, in the first the concentration of only hydrogen (H^+) ions,in the second the concentration of only hydroxide (OH^-)ions, and in the third the electrolyte water molecule weaker than hydrogen and hydroxide ions, and in the fourth example the hydrolysis reaction occurs to the end due to the formation of a base and volatile acid insoluble in water (Saginayev, 2022).

The next stage of the lesson is feedback. The level of knowledge of students is determined and fairly assessed by dividing and performing the knowledge gained in the course of group work at the second stage of the lesson into three levels. The measure of the result of the first level is 50 points.

Step 1 (individual work) – tasks of the *"know-it-all"* approach in theory are being prepared by students from home.

1. What is the name of the exchange reaction between salt and water? Answer: a chemical reaction that results in an exchange reaction that produces water and insoluble salts is called hydrolysis.

2. What concept does the term hydrolysis give, what concept does it give? The Greek "Hydro "means water,"lysos" means water.

3. What factors depend on the degree of hydrolysis of salts? Answer: 1)depends on the nature of The Salt; 2)the temperature of the Medium; 3)the concentration of the solution; 4)the charge of the Ion; 5)the radius of the Ion; 6)the deformation of the electronic circle of the Ion; 7) the dissociation constant(CD) of the formed weak electrolyte.

Step 2 (individual work) – tasks of approaches to *"application***"** in theory.

The following salts are given: sodium silicate, chromium (III) chloride, aluminum nitrate. How does the solution environment change when dissolving salts in water? *Answer:* the first shows an *alkaline* medium, the second shows an *acidic* medium, and the second shows a *neutral* medium.

1) if the concentration of [on-] ions in the electrolyte solution is [on-] =10–10 mol/L, is it possible to calculate [H+] ions? Answer: the concentration of [H+] ions [H+]=10–4/10–10mol / L. is it possible to calculate the pH value in the aqueous solution of this electrolyte? ph= - lg and the medium of the aqueous solution of this electrolyte will be acidic because the pH<7 (Goncharov, 2017).

The first intermediate result. The measure of the first result of students is 5 points. If the student is unable to complete the level tasks, "3" is put in the Journal in the journal.

The size of the second level is estimated at 89 points

Step 1 (individual work) – when performing tasks of approaches to *"understanding"* in theory, it determines *the reason.*

Task 1: Report. Why does the resulting solution show an alkaline environment when 10g HNO_3 is added to 10g NaOH solution? Prove your answer by generating a numerical problem?

Given:

m(NaOH) =10g; m (HNO3) = 10g.

Solution: mg (NaOH) = 40g;mg (HNO3) = 63g

We write the reaction equation: NaOH + HNO_3 = $NaNO_3$ + H2O

Interaction of NaOH and HNO_3 in a ratio of 40:63 = 4:6.3, the reaction will be neutral, and since we have a mass in a ratio of 10:10, the reaction will show an alkaline environment. Because NaOH is obtained in excess. We find in proportion how much NaOH is left in excess:

63g HNO_3- - - 40g NaOH;10g HNO_3 - - - -. 10g NaOH; HG (NaOH)= 6.38 G HNO_3

10g – 6.38 G = 3.62 g.answer: the medium is alkaline.

Step 2 (individual work) – tasks of approaches to *"analysis"* in theory. Compare the exchange of acids and bases using the Venn diagram 1-3,from the point of view of the new solvosystem theory.

Task 2: What is the essence of hydrolysis in the given equations?

$Cu^{2+}{}_{+}$ H_2O ↔Cu $OH^+ + H^+$; pH<7

CN^-+ H_2O ↔HCN + OH^-; pH>7

$Al^{3+} + 3CH_3COO^- + 3H_2O$ ↔Al $(OH)_3 + 3CH_3COOH$↑; pH= 7.

Answer: in the first case,hydrolysis occurs on the *cation* pH<7, since in the second case, hydrolysis occurs on the *anion* pH>7. in the third case, the hydrolysis reaction occurs *to the end* pH =7.

Step 3 (individual work) – tasks of approaches to *"application"* in practice.Give an example of how a chemical reaction occurs between salt and water.

Answer: for example, sodium carbonate Na_2CO_3 in water.

$$2Na^+ + CO_3^{2-} + HOH \leftrightarrow HCO_3^- + 2Na^+ + OH^- + H^+$$

in solution, a *weak* electrolyte (HCO_3^-) – *bicarbonate* forms an ion and a chemical reaction between salt and water occurs *to the end* of the *exchange* reaction.

The measure of the result of the middle interval is 89 points. In case of failure to complete the tasks of the following levels, "4" is put in the log.

Step 1 (individual work) – tasks of "accumulation" approaches in practice.Compare the given chemical reactions below and draw conclusions.*First example:*

$$NaCI + HOH \leftrightarrow NaOH + HCI;$$
$$Na^+ + CI^- + HOH \leftrightarrow Na^+ + CI^-;$$
$$HOH \leftrightarrow H^+ + OH^-$$

In the course of the exchange reaction, the concentration of *hydrogen* and *hydroxyl* ions does not change.Hydrolysis does not occur.*Second example:*

$$K_2CO_3 + HOH = NaHCO_3 + KOH$$
$$2K^+ + CO_3^{2-} + HOH \leftrightarrow K^+ + HCO_3^- + K^+ + OH^-$$
$$CO_3^{2-} + HOH \leftrightarrow HCO_3^- + OH^-$$

Only the *concentration* of *hydroxide* ions is accumulated.*Third example:*

$$CuCI_2 \rightarrow Cu^{2+} + 2CI^-$$
$$HOH \leftrightarrow H^+ + OH^-$$
$$Cu^{2+} + HOH \leftrightarrow (Cu\ OH)^+ + H^+$$
$$CuCI_2 + 2HOH = Cu(OH)_2\downarrow + 2HCI$$

Fourth example:

$$Fe_2S_3 + 6H_2O = 2Fe(OH)_3\downarrow + 3H_2S\uparrow$$

Conclusion

If we compare the four examples given above, it follows that in the first the *concentration* of only hydrogen (H+) ions, in the second the concentration of only *hydroxide* ions, and in the third the *concentration* of hydrogen penhydroxide does not change, and in the fourth example, the hydrolysis reaction occurs *to the end* due to the formation of a base and a *volatile* acid *insoluble* in water.

Step 2 (individual work) – the task of the *"assessment"* approach in practice.

Task 2. What is your opinion?

In my opinion:

If in solution the concentration of hydroxide ions (OH^-) is equal to the concentration of hydrogen (H^+) ions? When dissolving table salt in water:

$$NaCl + HOH \leftrightarrow Na^+ + Cl^+ + H^+ + OH^-$$

what do you think the environment shows? *Answer: the medium is neutral.*

If the concentration of hydrogen (H^+) ions in the solution is excessive? Ammonium chloride in the process of dissolving in water:

$$NH_4^+ + Cl^- + HOH \leftrightarrow NH_4OH + Cl^- + H^+$$

what environment does the salt solution reflect in your mind? *Answer:* medium *acidity*.

If the concentration of hydroxyl (OH^-) ions in the solution is excessive? In the process of dissolving sodium carbonate Na_2CO_3 in water:

$$2Na^+ + CO_3^{2-} + HOH \leftrightarrow HCO_3^- + 2Na^+ + OH^-$$

what environment do you think the salt solution shows? *Answer:* the medium is *alkaline*.

If the salt formed from a weak base and a weak acid is dissolved in water:

$$(NH_4)_2S \leftrightarrow 2NH_4^+ + S^{2-} NH_4^+ + HOH \leftrightarrow NH_4OH + H^+$$
$$S^{2-} + HOH \leftrightarrow HS^- + OH^-$$

What kind of salt solution in your opinion shows what environment? *Answer: fully* hydrolyzed.

How would you rate the examples given? Depending on the nature of the salt, the reaction medium will be weakly acidic or weakly basic. The *hydrogen* indicator – (pH) is used to determine the reaction medium. pH = - lg[H^+].

In the final result, 11 points scored from the previous level are added and a total of 100 are considered the result of the third level. The result is put in the journal" grade five". The quality of students ' knowledge is considered "correct", "complete", "action", "depth" and "consistency" and "firmness" (Torsykbaeva, 2015).

Results and discussion

In order to make sure of the effectiveness of this technology, a pedagogical experiment was conducted at the University, when the teacher directly interacts with students,survey questions were taken and an analysis was carried out.

In order to implement the use of the technology of a three-dimensional methodological system in chemistry, students of two universities were involved in the pedagogical experiment. The experiment was conducted by Astana Medical University in Astana under the educational program "General and Biological Chemistry" of the Astana Medical University in Astana and the educational program "Chemistry" at the Aktobe Regional University named after K. Zhubanov in Aktobe,which gave positive results.

Fig. 1. Survey conclusion diagram №1

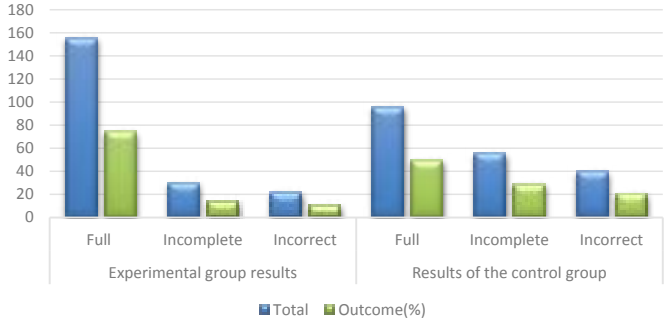

Fig. 2. Survey conclusion diagram №7

According to the results of Survey No. 7, the percentage indicators of the experimental group showed a higher degree than the first ones, and the indicator of the control group did not change to a significant extent. The results of the correct response of the experimental group and the control group were a ratio of 75:50.

Conclusions

The importance of the technology of a three-dimensional methodological system in teaching chemistry is very high,the level of knowledge and motivation of groups in the use of these technologies in order to increase students ' interest in chemistry, provide high-quality education and master it.

If the goal of training is fully consistent with the result of training, then it shows the effectiveness of the pedagogical process. Teaching technologies activities that raise the effectiveness of the constituent parts of the pedagogical system to a qualitative level. The use of the technology of a three – dimensional methodological system in chemistry increased students ' interest in the subject and revealed the ability to cognitive creativity. Students were taught to be inquisitive, to cooperate, to work together systematically, to be able to express themselves openly and freely.

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