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USE OF CHEMICAL EXPERIMENTS IN TEACHING ORGANIC CHEMISTRY IN GENERAL SECONDARY SCHOOLS

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Abstract:

This article examines the importance and effectiveness of using chemical experiments in the teaching of organic chemistry in general secondary schools. The article provides information on how the use of experiments contributes to a deeper understanding of the basic principles of organic chemistry by students. An analysis of literature sources and studies was carried out, and the effectiveness of using chemical experiments in increasing students' interest and passion for learning organic chemistry was determined

Keywords: Modern technology, alcohol, phenol, structural formula, chemical property, substitution effect, chemical experiment, test tube, glass rod

Today, the development of chemical and biological sciences in our country, the improvement of the quality of education and the effectiveness of science in these areas are among the priorities of the State Program "Year of Science, Enlightenment and Digital Economy".

After all, in-depth training of our sons and daughters in chemistry and biology will lead to the establishment of new production enterprises in the regions, pharmaceuticals, oil, gas, chemistry, mining, food, which create high added value. -provides the impetus for rapid development of the food industry and, ultimately, prepares the ground for increasing the living conditions and incomes of our people.

At the same time, it should be noted that the quality of teaching chemistry and biology in general education schools does not meet the requirements of today's times, teaching methodology and laboratories are outdated, mechanisms for the proper promotion of teachers' work have not been introduced [1].

Nowadays, the attention to increase the effectiveness of education using modern technologies-interactive methods in the educational process is increasing day by day. Until now, in traditional education, students were taught to acquire only ready-made knowledge. Such a traditional method extinguished independent thinking, creative research, and initiative in students [2].

Chemical experiments play a major role in the development of chemistry as a science. All important theoretical discoveries in chemistry are the result of summarizing a large number of experimental facts. Knowledge of the nature of substances is gained through experience, which helps to reveal the relationship and interdependence between them. In addition, the chemical industry is rapidly developing today, which requires highly qualified specialists who are trained by a specialized school, and then by technical universities. However, now, when studying chemistry in secondary schools, teachers devote less attention and time to chemical experiments. And so, There is a conflict between the existing need of society and their level of readiness for a high level of readiness of graduates of specialized schools to conduct chemical experiments. Therefore, forming the skills of conducting chemical experiments in high school students of a specialized school is an important practical task.

The purpose of our study was to select and apply chemical experience in vocational teaching of chemistry in high school. The research is based on the following hypothesis: if in the process of teaching chemistry: "Alcohols and phenols", chemical experience is systematically used, it helps to improve the quality of students' knowledge. To achieve the goal and test the scientific hypothesis, the following tasks were put forward:

1. To reveal the nature of specialized education and its organization in secondary school.
2. Analysis of the proposed chemical experiment on the topic "Alcohols and phenols" in the specialized educational program of the science teacher in chemistry and identification of its shortcomings.
3. Determine the principles of choosing experiments for a school chemical experiment and choose experiments on the topic "Alcohols and phenols".
4. Development of lesson notes on the topic "Alcohols and phenols" with the help of a chemical experiment and checking the effectiveness of their use in the process of specialized teaching of chemistry.

As a result of our research:

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1. The essence of specialized education and its organization in the general education school is revealed.

2. The chemical experiment on the topic "Alcohols and phenols" proposed by the science teacher in the profile teaching program of chemistry was analyzed and its shortcomings were identified.

3. The principles of selection of experiments for the school chemical experiment were defined and experiments on the topic "Alcohols and phenols" were selected.

4. Lesson notes on the topic "Alcohols and phenols" were developed with the help of a chemical experiment, and the hypothesis put forward by us was confirmed, if a chemical experiment is carried out during the study of the topic "Alcohols and phenols" in the process of teaching chemistry. used systematically, it can help improve student achievement. As an example, a lesson on the topic "Alcohols" is given.

Topic:"Alcohols". Preparation and chemical properties of monoatomic saturated alcohols.

*The purpose of the lesson:*study of chemical properties of monoatomic saturated alcohols. Duties:

1) Educational: study of chemical properties of monoatomic alcohols: combustion, interaction with alkali and alkaline earth metals, halides, intermolecular and molecular dehydration. Developmental: to increase the ability of students to predict the properties of a substance based on its structure, to develop the ability to observe, analyze and draw conclusions using chemical experiments. 2) Educational: formation of students' dialectical-materialistic outlook.

*Type of lesson:*combined.

Methods: oral (story), visual-effective - chemical experiment.

Equipment and reagents: round-bottomed flask, vertical glass stopper, alcohol lamp, matches, 3 test tubes, glass rod, filter paper; alcohols: ethyl, methyl and butyl, metallic sodium, beer.

Structure of the lesson: I. Introduction (12 min)

1. Lesson organization (1÷2 min)

2. Unlocking prior knowledge (7÷8 min)

3. Preparing students to perceive new material (1) -2 min)

II. The main part (21÷23 minutes)

III. The final part (9÷10 min.) 1. Uncovering their understanding of the studied material (5-6 min) 2. Conclusion (2 min) 3. Homework (1-2 min)

Course of the lesson: I. Introduction Good day, children. In the last lesson, we covered the topic "Alcohols, their composition, classification, nomenclature and isomerism, structure, physical properties, production and use." Frontal conversation.

1. What substances are called alcohols? (organic substances whose molecules contain one or more hydroxyl groups (-OH groups) attached to a hydrocarbon radical).

2. How are alcohols classified according to the number of hydroxyl groups? (monatomic, polyatomic: diatomic, triatomic and polyatomic).

3. How are monoatomic alcohols classified according to their radical? (Alcohols are divided into marginal, unsaturated, aromatic).

4. What substances are called limiting monoatomic alcohols? (Derivatives of saturated hydrocarbons in whose molecules one hydrogen atom is replaced by a hydroxyl group).

5. Tell the formulas of these alcohols: methanol (CH_3OH), ethanol (C_2H_5OH), propanol (C_3H_7OH), butanol (C_4H_9OH), pentanol ($C_5H_{11}OH$).

6. What groups of atoms are called functional? (Functional groups are groups of atoms that determine the characteristic chemical properties of a certain class of substances).

7. Which functional group does alcohol belong to? (hydroxyl group).

8. What are the physical properties of alcohol? (The lower and middle members of the series of saturated monohydric alcohols containing one to eleven carbon atoms are liquids. Higher alcohols (beginning with $C_{12}H_{25}OH$) are solids at room temperature. Lower alcohols have a characteristic alcoholic odor and burning taste, and are soluble in water. the solubility of alcohols in water decreases, and octaethanol does not mix with water. Glycerin (propanetriol-1,2,3) is a viscous, syrupy liquid with a sweet taste. it is infinitely soluble in water, it is not volatile).

Task: Write the names of substances:

A) $CH_3 - CH_2 - CHOH - CH_3$ (butanol-2);

B) $CH_3 - CHOH - CH = CH_2$ (buten-1-ol-3);

C) $CH_3 - CH(CH_3) - CHOH - CH_2 - CH_3$ (2-methylpentanol-3)

II. The main part. We turn to the study of new material. We write the subject of the lesson in the notebook: "Alcohols. Preparation and chemical properties of monoatomic saturated alcohols.

The purpose of our lesson is to study the chemical properties of monohydric alcohols. We will work according to the following plan: (written on the board):

1. Combustion of alcohols

2. Interaction with alkaline and alkaline earth metals

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3. Halogen interaction with hydrogen

4. Intermolecular and molecular dehydration of alcohols.

The properties of organic substances are determined by their composition and structure. Alcohol confirms the general rule. Their molecules contain hydrocarbon and hydroxyl radicals, so the chemical properties of alcohols are determined by the interaction of these groups and their effect on each other. Properties of this class of compounds are associated with the presence of a hydroxyl group.

1. Burning alcohol. Demonstration of video experiment - burning alcohol $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$

2. Interaction of alcohols with alkaline and alkaline earth metals.

Instruction of the teacher- interaction of monohydric alcohols with sodium.

*Required equipment and reagents:*3 test tubes, glass rod, alcohol lamp, filter paper; alcohols: ethyl, methyl and butyl, metallic sodium.

*Experimental work progress:*1-2 ml of methyl, ethyl and butyl are poured into 3 test tubes and a small piece of sodium metal dried with filter paper is dropped into each of them. Observe the evolution of flammable gas. The reaction is most intense in a test tube with methyl alcohol, and slower in a test tube with butyl alcohol. After the reaction in a test tube filled with ethyl alcohol, sodium ethoxide is separated. To do this, we lower the glass rod into the test tube and hold it over the stove flame. Excess alcohol evaporates. A white coating of sodium ethoxide remains on the stick [3]. To determine the effect of the hydrocarbon radical on the hydroxyl group, on the one hand, it is necessary to compare the properties of substances with a hydroxyl group and a hydrocarbon radical, and with a hydroxyl group and without a hydrocarbon radical. , on the other hand. Such substances can be, for example, ethanol (or other alcohol) and water. The hydrogen of the hydroxyl group of alcohol molecules and water molecules can be reduced (replaced by them) by alkali and alkaline earth metals. This difference is explained by the electron donating properties of the radical closest to the hydroxyl group. A radical with the properties of an electron donor (I-type substituents) slightly increases the electron density in the oxygen atom, "saturates" it at its own expense, and thus makes the -OH bond more polar and "acidic" reduces the the nature of the hydrogen atom of the hydroxyl group in alcohol molecules compared to water molecules [3].

3. Interaction of alcohols with hydrogen halide. Conducting a virtual experiment - the interaction of ethyl alcohol with hydrogen bromide. Replacing the hydroxyl group with a halogen leads to the formation of halogen derivatives of alkanes. For example: $C_3H_7OH + HBr \rightarrow C_3H_7Br + H_2O$

4. Intermolecular dehydration of alcohols is the separation of a water molecule from two alcohol molecules when heated in the presence of water-releasing agents: $2R - OH \xrightarrow{H^+} R - O - R + H_2O.$

As a result of intermolecular dehydration of alcohols, esters are formed. Thus, when ethyl alcohol is heated with sulfuric acid from 100 to 140 °C, diethyl (sulfur) ether is formed:

In general $ROH + R'OH \xrightarrow{t<140°,\ H^+} ROR' + H_2O$

$CH_3 - CH_2 - OH \xrightarrow{t<140°,\ H^+} CH_3 - CH_2 - O - CH_2 - CH_3$

5. Dehydration of molecular alcohols occurs when alcohols are heated to a temperature higher than the intermolecular dehydration temperature in the presence of dehydrating agents. As a result, alkenes are formed. This reaction is due to the presence of a hydrogen atom and a hydroxyl group on neighboring carbon atoms. An example is the reaction of obtaining ethene (ethylene) by heating ethanol above 140 °C in the presence of concentrated sulfuric acid:

$$CH_3 - CH_2 - OH \xrightarrow{t>140°,\ H^+} CH_2 = CH_2 + H_2O$$

Ethanol is used to make alcoholic beverages. It is found in beer and wine.

Student exhibition - determination of alcohol content in beer Equipment and reagents: round bottom flask, vertical glass tube stopper, alcohol lamp, matches; beer.

The progress of the experimental work: pour 50-100 ml of beer into a round-bottomed flask, close it with a cork with a vertical glass spout. Heat the flask to boiling, and after some time ignite the alcohol vapors at the upper end of the tube. Beer must first be shaken well to remove carbon dioxide, otherwise strong foam will form when heated [3].

III. The final part

Summary. Today in the lesson we started to study the topic "Alcohols". Chemical properties of alcohol. We got acquainted in detail with the combustion of alcohols, their interaction with alkaline and alkaline earth metals, hydrogen halides, as well as intermolecular and intramolecular dehydration of alcohols.

Homework:

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1) Summarizing the topic material in a notebook;

2) study pages 110-137 of § 3.2 ÷ § 3.7

3. Exercise. Various types of chemical experiments were used in the experimental class to study the topic "Obtaining, properties and use of saturated monohydric alcohols and phenols": demonstration experiments, virtual and mental experiments, laboratory and practical work on this topic. formation of elements of knowledge. In the control class, lessons were conducted using a chemical experiment proposed by the program prepared by the teacher. The percentage expression of the quality of knowledge of the students in the experimental class is 84%, and in the control class is 62%, which indicates the effectiveness of introducing the lesson notes, which include various types, into the educational process.

In addition, we can make the following general conclusions about our work on this topic:

1) Hands-on experiments help students understand theoretical concepts: Chemistry experiments give students the opportunity to interact with materials, conduct scientific research, and observe reactions, which help them better understand the basic principles of organic chemistry. Visual and hands-on experience can make complex concepts more accessible and memorable.

2) Developing Laboratory Skills: Chemistry experiments develop students' laboratory skills such as measuring accurately, mixing reagents, observing reactions, and interpreting results. These skills can be useful for future careers in science and engineering.

3) Integration of theory and practice: Chemistry experiments allow students to apply theoretical knowledge in practice, which helps to strengthen their understanding of organic chemistry. They also help students see the connection between chemistry and everyday life by showing the applications of chemistry in various fields such as food, medicine, materials, and the environment.

In general, although the use of chemical experiments in the teaching of organic chemistry in general secondary schools has many advantages for students, it requires careful planning, preparation, and safety precautions. does. It can support students in their learning, develop their interest in science and organic chemistry, and help them better understand complex concepts through hands-on experience.

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