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OF CHEMICAL EXPERIMENTS IN THE PROCESS OF CHEMISTRY TEACHING

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Abstract:

This article examines the importance and effectiveness of using chemical experiments in the process of teaching 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. The analysis of literature sources and studies was carried out, and the effectiveness of using chemical experiments in increasing students' interest and enthusiasm for learning organic chemistry was determined.

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

Currently, one of the main tasks of school education is the introduction of a competency-based approach to the educational process.

The use of this approach in teaching chemistry requires the teacher to regularly update methodological tools, to search for new ways to achieve educational goals. One of the solutions to this problem is the concept of problem-based education.

In contrast to traditional methods, this concept introduces into the theory and practice of education a system aimed not only at stimulating the knowledge interests and thinking of students, but also at developing their creative abilities. 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".At the same time, it should be noted that the quality of teaching chemistry and biology in secondary schools does not meet the requirements of today's era, teaching methodology and laboratories are outdated, and mechanisms for the proper promotion of teachers' work have not been introduced.Chemistry occupies an important place in the world of science and education, and its study requires not only theoretical knowledge, but also practical skills. One of the effective methods of teaching chemistry is the use of chemical experiments in the educational process [1]. Nowadays, the attention to increase the efficiency of education by using modern technologies-interactive methods in the educational process is increasing day by day. Until now, in traditional education, students were taught only to acquire ready-made knowledge. Such a traditional method extinguished independent thinking, creative research, and initiative in students [2, 4].

The purpose of our research was to select and apply chemical experience in vocational teaching of chemistry in high school.

As a result of our research:

1. The essence of specialized education in a general education school and its organization are 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 we put forward was confirmed, if in the process of teaching chemistry, a chemical experiment is conducted when studying the topic "Alcohols and phenols".

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: to study the chemical properties of monoatomic saturated alcohols.

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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 cork, alcohol lamp, matches, 3 test tubes, glass rod, filter paper;

alcoholic beverages: ethyl, methyl and butyl, sodium metal lump, 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.

Main part (21÷23 minutes)

III.

The final part (9÷10 min.) 1. Uncovering the concepts 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), (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 from one to eleven carbon atoms are liquids. Higher alcohols (starting with $C_{12}H_{25}OH$) are solids at room temperature.

Assignment: Write the names of substances:

A) CH_3 - CH_2 – CH(OH) - CH_3 (butanol-2);

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

C) CH_3 – $CH(CH_3)$- CH(OH) - CH_2 - CH_3 (2-metilpentanol-3)

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 goal 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

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 of alcohol $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$

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

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Teacher's instruction - the interaction of monohydric alcohols with sodium.

Necessary tools and reagents: 3 test tubes, glass rod, alcohol lamp, filter paper;

alcohols: ethyl, methyl and butyl, metallic sodium.

The course of the experiment: 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 flame of the stove.

Excess alcohol evaporates.

A white coating of sodium ethoxide remains on the stick [3].

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 characteristics of an electron donor (I-type substituents) slightly increases the electron density in the oxygen atom, "saturates" it at its own expense, and thereby increases the polarity of the -O-H bond and "acidity" reduces the nature of the hydrogen atom of the hydroxyl group in alcohol molecules compared to water molecules. Conducting a virtual experiment - the interaction of ethyl alcohol with sodium

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 substances: $2R-OH \xrightarrow{H^+} R-O-R + H_2O$.

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

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

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

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 associated with 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:

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

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

The course of the experiment: 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.

III. The final part

Summary. Today in the lesson we started studying 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:

1) Summarizing the topic material in a notebook;

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

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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