



"INNOVATIVE ACHIEVEMENTS IN SCIENCE 2023"

DEVELOPMENT OF STUDENTS' INDEPENDENT WORK SKILLS WITH VIRTUAL LABORATORY EXPERIENCES

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The only way to eliminate and prevent the problems that exist now and are likely to arise in the near future is to direct the accumulated knowledge, formed skills and qualifications, acquired experience and conclusions to a single goal, and effectively combine the educational process with the development of technology. This, in turn, directly puts new tasks before educational institutions in our country.

According to the decision of the President of the Republic of Uzbekistan No. PQ-4805 of August 12, 2020, Annex 5, Clause 19, part two, "Virtual laboratories" are included in the educational process in higher and professional educational institutions starting from the 2021-2022 academic year. Phased implementation tasks are defined [1].

We know that chemistry is an experimental science, and it is difficult to master the subject without laboratory experiments in teaching this science. Most secondary schools do not have enough reagents to collect chemical equipment and conduct experiments so that students can perform independent experiments. That time is the main obstacle to the fact that students do not have enough time to perform experiments, make experimental conclusions, strengthen the subject, and do not form the necessary knowledge and skills [2].

In teaching the topic of qualitative reactions to gases, the detection of carbon dioxide, hydrogen and oxygen gases in the virtual laboratory program "Crocodile chemistry" is carried out in the following steps.

1. First, the Crocodile Chemistry program installed on our computer is launched.

2. After starting the program, select the Contents→Identifying Substances→Test for gases section on the left side of the window.

3. In the Test for gases section, you will be presented with 3 different gas cylinders, a calcium hydroxide solution, a gas tube, a glass, and a match. You will



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learn to identify 3 different gases using these reagents and equipment. Of course, the program itself will guide you on how to do this.

4. Then "Limewater" is poured into the glass, a gas cylinder filled with carbon dioxide is taken and connected to the gas pipe in the glass, carbon dioxide gas is sent through the tube and the lime water in the glass starts to turn white. This is the qualitative reaction for carbon dioxide. After the experiment, you can see what substances are in the glass and the reaction equation.

5. After detecting carbon dioxide gas, remove the carbon dioxide gas cylinder. The substance inside the beaker is emptied.

6. Then we place a gas cylinder filled with hydrogen next to the glass and connect the gas cylinder to the gas tube.

7. Let's check the hydrogen gas coming out of the tube with the help of fire. The hydrogen blew out the smoldering flames with a hiss.

8. After removing the hydrogen gas cylinder, we install the oxygen gas cylinder and connect it to the gas tube. Then when we bring the "glowing splint" i.e. the matchstick in the program to the tube, we can see that the oxygen gas coming out of the tube ignites the matchstick.

Advantages of using "Crocodile chemistry" virtual laboratory program in teaching qualitative reactions to gases:

- saves the time of the teacher and the student during the lesson
- Teachers will be able to clearly and visually explain laboratory experiments
- Caution is not required, that is, your safety is ensured
- All chemicals are on your computer, no need to search for different substances
- cleaning and washing of chemical equipment and dishes is not required after the experiment
- Reagents are saved
- The student can perform laboratory work independently through the program
- You will be able to perform impossible experiments without difficulty
- Students develop computer technology skills
- Since the program is in English, students' English language skills develop and their vocabulary increases.
- students' interest in chemistry increases
- After the end of the experiment, it is possible to know the equation of the reaction and what substances are present in the reaction vessel



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Experiments not possible in Crocodile Chemistry are easy to do. It is almost impossible to conduct experiments with gases in normal laboratory conditions. However, any experiment can be easily done through this program.

Crocodile Chemistry is very easy to use in the educational process, and this program has many conveniences compared to doing typical laboratory experiments. Proper hands-on labs are n't without their advantages, but reagents are n't always readily available. In addition to laboratory classes, the computer program can be used in other classes as well. In addition, virtual laboratories increase students' interest in chemistry, increase their knowledge, skills and abilities, develop skills to independently perform laboratory experiments independent of computer technology and chemistry.

REFERENCES:

1. O'zbekiston Respublikasi Prezidentining 2020 - yil 12 - avgustdagi PQ-4805-son qarori.
2. Atullaev. Z.M., The Role of Virtual and NonStandard Laboratory Experiences in the Development of Student's Independent Work Skills // Eurasian Journal of Learning and Academic Teaching. cl asses Involume 11, of Eurasian Journal of Learning and Academic Teaching (EJLAT) August, 2022. ISSN (E): 2795-739X JIF: 8.225