MODELING AND CONSTRUCTION OF MOLECULES AS A DIDACTIC RESOURCE FOR TEACHING CHEMISTRY

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An important role in teaching is played by means of visualization, which provide the ability to demonstrate, create an image of the object or phenomenon under study. The practice of teaching chemistry has shown that spatial imagination is of particular importance. Due to the undeveloped ability to mentally model and "imagine" various projects or structures, to see them with internal vision in color and detail, the chemical structure of substances is perceived quite difficult, as a result, difficulties arise in the study of inorganic and organic chemistry.

Therefore, the combination of modeling and construction opens up broad perspectives in the educational process, which ensures the emergence of the didactic educational system and is an important component of improving the effectiveness of training.

The purpose of our work is to develop a methodological system aimed at the systematic use of modeling and construction of molecules as a means of visualization in the process of teaching chemistry.

Material and methods. The research material is based on didactic and methodological aspects of the use of visualization in the educational process in chemistry, the use of construction and modeling methods in the study of inorganic and organic chemistry.

Findings and their discussion. As a result of the study, it was found that the most common were ball-and-stick models due to the simplicity of their production and ease of demonstration. Models are designed to develop spatial imagination, stimulate thinking, and facilitate the visualization process. They are presented to the student as a solid form of an abstract object that otherwise only a chemist could visualize. While in the textbooks of chemistry for the description of molecules using text, symbols and graphics, molecular models make them "real."

Molecular models are as vital a tool for learning chemistry as calculators are for learning mathematics. Molecular Visions models can be assembled in endless combinations, allowing the user to create not only familiar configurations, but also unknown possibilities that will allow chemists to construct new, complex and potential valuable molecules.

For the research, we used a set of "Chemical constructor". The set includes:

1. Balls. These are models of atoms of various elements. A certain type of atom (chemical element) has an individual color. The holes in the balls correspond to the valence of the elements.

2. Flexible plastic rods. They are used to model single, double, and triple bonds.

Atoms	Holes/Bond Angle	Color	Dia.(mm)	Qty
H-Hydrogen	1/-	white	17	40
C-Carbon	3/120º	black	23	12
	4/109º28			20
	2/180º			2
O-Oxygen	2/105º	red	23	6
	4/109º28			1
N-Nitrogen	3/107º	blue	23	3
	4/109º28			4
S-Sulfur	2/105º	yellow	23	2
	4/109º28			2
	6/90º			2
F-Fluorine	1/-	orange	17	6
Cl-Chlorine	1/-	green	23	6
Br-Bromine	1/-	brown	23	3
1 valence metal	1/-	silver	23	2
2 valence metal	2/105º	grey	23	1
6 valence metal	6/90º		23	1
P-Phosphorus	5/120º +90º	purple	23	1
I-Iodine	1	deep purple	23	2

You can use the basic functions that are fundamental in the “Chemical Constructor”:

• Visualization of rod, ball-and-stick, scale models.

• Support for single, double and triple bonds.

• Building models of molecules of cyclic compounds.

• Visualization of atomic orbitals and electronic effects.

• Obtaining information about the length of bonds and symbols of chemical elements in a molecule.

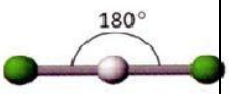
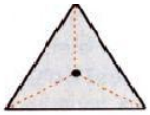
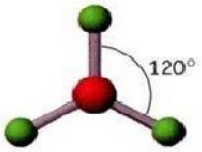
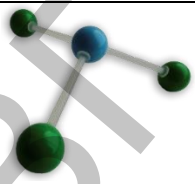
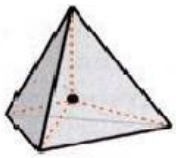
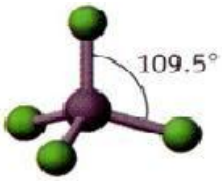
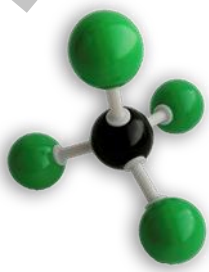
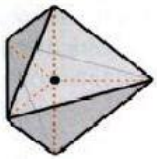
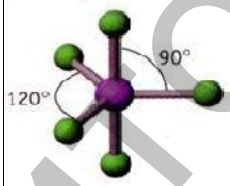
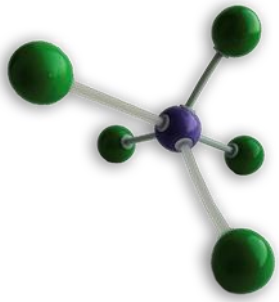
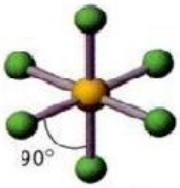
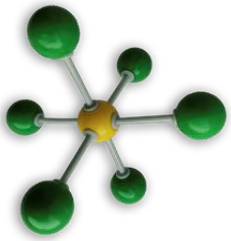
• Compliance with the rules of valences and angles between bonds in a molecule, which guarantees the reliability of the resulting models of chemical compounds.

• Conversion of graphical two-dimensional structures in three-dimensional models.

To conduct the research, we have developed a set of tasks using a set, which can be sufficiently familiar with group and individual work.

Fragment of the project "Assemble a molecule":

Conclusion. In our opinion, such a diverse application of models is fully

Name	Figure	3D-model	Example	Picture
Liner			BeF_2	
Trigonal-planer			BF_3	
Tetrahedral			CF_4	
Trigonal-bipyramidal			PF_5	
Octahedral			SF_6	

justified from the didactic point of view since it provides the necessary visual aids for the educational process. Therefore, there is an objective need to teach students to correctly identify the characteristic properties of the object under study, use modeling and construction when studying educational material, which allows avoiding fragmentation and knowledge.