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Teaching Organic Chemistry in Higher Education Institutions

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Annotation: The features of teaching organic chemistry, the basics of biochemistry and the chemistry of oil and gas in higher education are considered. Methodological techniques are proposed to improve the assimilation of the material in the disciplines under consideration, taking into account the specifics of modern student youth.

Keywords: Teaching methodology, organic chemistry, oil and gas chemistry, interdisciplinary connections, visualization of the material, clip thinking, fatigue, attention concentration, logic.

INTRODUCTION

Organic chemistry and related branches of knowledge (biochemistry, chemistry of oil and gas, chemistry of macromolecular compounds) from the moment of their formation as separate academic disciplines and up to the present time represent a noticeable difficulty for mastering. This complexity stems, firstly, from the extremely extensive nature of the collected and systematized knowledge, comparable only to the amount of knowledge in medicine, and secondly, from the fundamental difficulty of a logical description of a number of chemical phenomena: many reactions in organic chemistry have a complex mechanism and lead to the formation of a mass of by-products. It should be noted that at least two more factors complicate the assimilation of the discipline: this is the complexity of the spatial images of polyatomic molecules, the pregrouping of atoms in the course of chemical reactions, and the need to turn to other chemical disciplines and freely operate with the concepts of general chemistry, quantum chemistry, chemical thermo- dynamics and chemical kinetics, and in some cases, the chemistry of dispersed systems.

MATERIALS AND METHODS

As one of the clearest examples of interdisciplinary links between organic chemistry and general chemistry, let us mention the theory of resonance. It is very illustrative and very useful in determining the position of substitution in the aromatic ring, however, after the well-known unfair criticism of the 1950s–1960s. few organic chemists include this theory in their lectures and even fewer teachers are able to correctly explain to students the origins of this theory [1]. Let's try to figure this out. So, in 1926, the British scientists Walter Heitler and Fritz Lonoden proposed a method of quantum-chemical calculations of the electron density distribution in polyatomic molecules, which later became known as the Valet Bonds (BC) method [2]. In accordance with this theory, a polyatomic molecule is considered as a collection of valence electrons and atomic nuclei (taken together with the "core" electrons), and valence electrons can be distributed differently between the nuclei of the atoms that make up the molecule. The probability of this or that distribution of electrons between atomic nuclei is not the same. The superposition of all possible variants of the distribution of electrons over the atoms of a molecule, taking into account the probability of their implementation, makes it possible in the course of quantum mechanical calculations to describe the real picture of the electron density distribution in the molecule and its reactivity [2].

RESULTS AND DISCUSSION

Chemistry as one of the fundamental, fundamental and ideological disciplines is the methodological basis for acquiring general professional experience in the formation of the natural science culture of an agro-industrial complex specialist. Therefore, the development of existing and the search for new scientific and methodological approaches in teaching the course of chemistry at various stages of personality education remains an urgent task of general and professional pedagogy.

The discipline "Organic Chemistry" in institutions of higher professional education is designed to ensure the deepening and expansion of students' knowledge about nature and nature management. This is carried out on the basis of the continuity and development of basic chemical concepts, the assimilation of the leading laws, consequences, theories, scientific facts, showing the practical application of chemical knowledge in the professional activities of future specialists.

Innovative education is focused not so much on the transfer of knowledge that is constantly outdated, but on mastering basic competencies, which then allow them to acquire knowledge on their own. In this regard, the phrase "learn to learn" in the modern context sounds especially relevant. The correct organization of independent work on the discipline allows the student not only to consciously and firmly acquire knowledge on the subject, but also to master the necessary methods and techniques of self-education. The effectiveness of independent work depends on various factors: from the teacher's planning of students' independent work, the saturation of the educational process with various forms of independent work (homework, individual tests, completion of lecture notes, writing essays). The student must be ready to search for

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information from various sources and he must process this information into knowledge. The competence and mobility of a university graduate should become its main characteristic.

Technological progress does not stand still. The amount of information our civilization owns is doubling every year. Therefore, in order to master knowledge, it is also necessary to master the techniques with which you can receive, process and use new information. Computer equipment, multimedia systems, the latest devices, installations, entire automatic modules should be actively used in the educational process at the present stage. Students should be at the forefront of technological progress and promote the integration of science and industry.

Particularly relevant are laboratory works in which biological objects serve as the research material. An example of the subject of such works is the work for the direction of preparation "Agronomy": "Biologically active substances of root crops", "Measurement of the mass fraction of amino acids in root crops by capillary electrophoresis". The purpose of these works is to determine the content of protein, fiber, starch, amino acids. Students, having experience in working with instruments, select methods and perform an experiment. The work of students can be considered successful if the skills and abilities to find cause-and-effect relationships as a result of experimental work are formed, to apply the acquired knowledge in their future profession.

It should be specially emphasized that each of the variants of the "settlement" of electrons over the atoms of a molecule, the so-called resonant structure, is not a real-life object, but a quantum-chemical model, and can only be considered as such. However, due to the discreteness and corpuscularity of the electron on the one hand, and its wave nature on the other hand, the probability of the appearance of an "extra" electron and, consequently, the occurrence of a chemical reaction at one or another carbon atom of the molecule will correlate with the possibility of realizing the corresponding resonant structures.

Along with the complexity of the material presented, there are objective difficulties in mastering it, associated with the so-called clip thinking [3], which is now common among a significant part of students. Under the term “clip thinking” is understood as the perception of information in the form of a short, bright, outwardly expressive image. The English word “clip”, from which this term is derived, denotes any piece of text, film or clipping from a newspaper or magazine. The clips do not carry a semantic load, they are a video sequence of several interconnected images [3].

According to modern ideas, “thinking is the highest form of reflection of objective reality, consisting in purposeful, mediated and generalized knowledge by the subject of essential connections and relations of objects and phenomena, in the creative creation of new ideas, in predicting events and actions. in the process of setting and solving practical and theoretical problems" [4]. Thus, thinking includes not so much primary perception, fixation, as the active side of cognition: in the formation of associations, the formation of concepts and judgments. Thinking is verbal, that is, it is tied to our speech. Based on the foregoing, it is hardly at all legitimate to call the so-called clip thinking the term "thinking", because it comes down precisely to the emotional perception of the "picture": external non-verbal images, while the process of further associative or systematic processing of the received information is partially or completely absent. mation. In the process of clip thinking, as a rule, long-term memory is not involved. An individual can easily be distracted from such a superficial perception of boring information, the concentration of attention is insufficient for a long-term concentrated perception of homogeneous material [3].

Even if such students remember part of the material presented by the teacher, they are not able to analyze it, build logical chains, and are incapable of associative thinking, which is so necessary when mastering organic chemistry and related academic disciplines. At the same time, some features of clip thinking inherent in students can and should be used in the course of teaching.

CONCLUSION

Modern multimedia tools make it possible to present in an animated form the shift of the electron density in molecules, the features of the mechanism of a particular reaction and the transition states that occur during the course of the reactions, the resulting products. The ability to highlight certain structural fragments of molecules with a color or background, demonstrate internal rotation, rearrangements, etc. simplifies the selection of the main thing in the presented, at times, very complex picture of a chemical reaction. Thus, in the mind of the student, not a scholastic set of postulates and formulas is formed, but a figurative picture familiar to his mind. At the same time, the methodology of assimilation of the material changes significantly, the graphic image becomes the foundation, around which the main concepts and concepts are grouped. The student receives a scheme, a "framework" for further independent assimilation of the material, which, ultimately, contributes to the formation of a normal analytical mindset, which is necessary for a future engineer.

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