ISSN 2195-1381 Volume- 3 April 2025
https://journal-index.org/index.php/ajasr

THE USE OF PROBLEM-BASED TEACHING METHODS IN THE STUDY OF THE TOPIC "CYCLIC HYDROCARBONS"

Ibodulloyeva Majvuda Ibodulloyevna

Associate Professor of Nizamiy TSPU

mibodulloyeva69@gmail.com

Turayeva Charos Okiljon kizi

4th year student of Chemistry

Annotation. The article provides information on the study of the topic "Cyclic hydrocarbons" using interactive methods, mainly on the importance of problem-based teaching methods and their correct application.

Keywords: method, innovative technology, innovation, problematic method, problem-based learning, problem situation, cyclic connections, method of monological utterance, method of dialogical utterance, method of heuristic tasks, method of research tasks.

Today, the application of innovations in the educational process requires the implementation of the following tasks: determining the specific purpose of the subject, determining the scope and content of the subject, developing and recommending the necessary educational technologies, creating material and technical support for the subject, studying the characteristics of learners, preparing the teacher and designing the lesson. The most important of the above tasks is the development of educational technologies that are most suitable for organizing this educational process. These problems cannot be solved by recommending one or another specific method, especially if the teacher aims to use only reproductive teaching methods. The most correct way to achieve this goal is to develop educational technologies for these lessons and search for opportunities for their effective use at different stages of the lesson [1].

In order to ensure that the problem is accepted by students, it is recommended to organize an attempt to solve it when posing the problem. In this way, the teacher analyzes the expected solution with the students, identifies the difficulties they encounter. As a result of the initial attempt to solve the problem, the students determine that it cannot be solved easily. In this case, the problematic situation serves as an internal psychological justification for the need to further explore ways to solve the problem.

The teacher, having posed a problematic question and received an answer, should not evaluate the correct and incorrect answers, but should demand a comprehensive and comprehensive answer from the students. If the student cannot adequately justify the expected specific answer, he should identify other students who are interested in this answer and invite them to justify this answer together.

As a result of organizing problem-based learning, students have creative opportunities to develop knowledge, skills, and thinking abilities.

In problem-based learning, the teacher's activity is such that, if necessary, he regularly creates problem situations between students and the subject material being studied, explaining the content of the most complex concepts, informs students about the facts, as a result of which students independently draw conclusions and generalize based on the analysis of these facts [2].

Monologue presentation method. A problem situation is created on the topic of "Cyclic compounds", the main concepts of these compounds, the essence of the topic are explained. Students express their ready-made conclusions on the information obtained on the topic.

When using the method of reasoning and presentation on the topic of cyclic compounds, the lesson is organized based on the following stages:

1. Creating a problem situation (introductory part). The lesson can be started with an interesting question or an example from everyday life:

Question: Why do benzene and naphthalene have a stable structure, but cyclic alkanes (for example, cyclopropane) are very reactive?

Example: What are the properties of cyclic compounds found in automotive fuel or pharmaceuticals?

This stage is important to increase students' interest in the topic and encourage them to think independently.

2. Presentation of the topic (main part)

The topic “Cyclic compounds” is presented to students based on problem-based thinking and consistent analysis.

Comparison of cyclic and open-chain compounds:

Differences between aliphatic and aromatic cyclic compounds.

What are the differences in terms of stability and reactivity?

Why are cyclopropane and cyclobutane less stable?

Why is cyclohexane considered the most stable cyclic alkane?

The stability of benzene - an explanation based on resonance theory.

3. Drawing conclusions and generalizing

The stability of cyclic compounds and their chemical properties are discussed.

The practical importance of cyclic compounds is summarized.

Students reinforce the lesson by solving examples on the topic. This method helps students think independently, develops an analytical and logical approach, and allows for a deeper understanding of the topic.

Using the dialogical presentation method on the topic of aromatic hydrocarbons.

The dialogical presentation method is a method of explaining a lesson through interactive communication between the teacher and the student (or group of students). This method can ensure the active participation of students and encourage them to think.

1. Questions and answers about the structure and stability of benzene.

Teacher: Benzene is a very important compound in chemistry. However, its structure has long been a mystery to chemists. Do you think benzene can react like ordinary alkenes?

Student 1: Aromatic hydrocarbons have carbon-carbon double bonds, so they may resemble alkenes.

Teacher: But benzene, despite having double bonds, does not decolorize bromine water like alkenes. Why do you think so?

Student 2. Aromatic hydrocarbons may have a more stable structure.

The teacher explains that the stability of benzene is related to its resonance structure based on the Kekule structure

In conclusion, through the dialogic presentation method, students actively participate in the lesson process, develop thinking, guessing and logical analysis skills, the topic becomes lively and understandable, and the level of mastery increases. Students' activities include a set of reproductive and partially-search methods of teaching.

Applying the method of heuristic tasks to cyclic compounds.

Today, the development of students' creative activity through heuristic tasks is a requirement of the time. The heuristic task method is a method aimed at developing students' independent thinking and scientific research skills by asking them problematic questions or interesting problems. Creating problem situations in creative activities is important to involve students in solving these problem situations [3].

This method helps to deeply master the topic of cyclic compounds.

Question: Why is cyclopropane less stable, and benzene, on the contrary, is a very stable compound?

Task: Explain what the bond angle of the cyclopropane and benzene molecules is.

Expected result: Students discuss bond angles. The bond angles of the cyclopropane (C_3H_6) and benzene (C_6H_6) molecules are as follows:

Cyclopropane (C_3H_6) forms a three-membered ring, and each carbon atom has sp^2-hybridization. Theoretically, the ideal bond angle for an sp^2-hybridized carbon should be 120°. However, because the ring in cyclopropane is very small, the bond angle is 60°. This small angle creates “ring strain,” which makes cyclopropane unstable.

Each carbon atom in benzene (C_6H_6) is sp^2-hybridized, that is, has a trigonal planar structure. The bond angle in an ideal trigonal planar structure is 120°. The structure of benzene is very stable due to resonance, and all the bonds are the same length.

So: In a cyclopropane molecule, the bond angle is 60°, and in a benzene molecule, the bond angle is 120°.

Students explain that cyclopropane has a large internal strain due to the 60° bond angle.

Heuristic tasks help students develop independent thinking and research skills, allowing them to acquire not only theoretical knowledge, but also logical analysis and a deep understanding of the topic. This method helps to study the stability properties of cyclic compounds based on real examples. Students' cognitive activity is maximally activated, their independent creative thinking develops.

The method of research tasks serves to develop students' independent thinking and improve problem-solving skills. Its application to cyclic compounds can be explained through examples. For example, studying the structure of benzene.

Assignment: Students are given the task of independently studying the structure of the benzene molecule. They must find answers to the following questions:

1. Why is the structure of benzene constantly cyclic?

2. What are the differences between Kekule's theory and the modern quantum mechanical approach?

As a result, students, using experimental results and theoretical materials, will be able to describe the structure of benzene and explain the reasons for its stability.

The main reason why the structure of benzene is permanently cyclic is that it obeys the rules of resonance and aromaticity. The chemical formula of benzene is C_6H_6, and its structure contains three double bonds and three single bonds. However, experimental data show that all carbon-carbon bonds in benzene are of the same length, which is different from the usual C-C (1.54 Å) and C=C (1.34 Å) bond lengths. This is explained by the phenomenon of resonance [5].

Benzene has two Kekule structures: this means that the π-electrons in benzene are delocalized throughout the ring and this situation is not explained by only one single or double bond. The free movement of these electrons gives benzene a symmetrical and permanently cyclic structure.

Hückel's rule is used to determine aromaticity. According to this rule, aromatic compounds: Have a cyclic (ring-shaped) structure, are planar. All members must be sp^2-hybridized, that is, each carbon atom must form π-electrons. The (4n + 2) π-electron rule must be followed. Benzene has 6 π-electrons (4(1) + 2 = 6 for n = 1), which means it is aromatic.

Benzene has a high resonance energy (stabilization energy), which makes it much more stable than typical alkenes and dienes. For this reason, benzene tries to preserve its double bonds in chemical reactions and does not react with double bonds like typical alkenes.

The teacher sets highly problematic theoretical and practical research tasks for students. The student, using independent logical thinking, reveals the essence of a new concept and a new approach. The forms of organizing research work can be various, including experiments, collecting facts, preparing a lecture, and modeling [6].

Thus, the organization of finding an answer to a problematic question combines a module of systematically laid steps, that is, students are asked a problematic question, students' attempts to think about finding and justifying answers to questions are organized. Problem-based learning is a form of organizing the educational process in which, under the guidance of a teacher, a problematic situation and effective independent activity of students in solving this situation are created.

LIST OF REFERENCES

1. Mamadaliyeva N. I., Ibodullayeva M.I., Sapayeva G.I., Rixsiyeva U. Sh.The Method of Creating Independent Educational Assignments Based on the Credit-Module System from Chemical Sciences Taught at the Undergraduate Level, Easy Chair Preprint, № 15647 January 6, 2025
2. Ибодуллоева М.И., Искандаров А.Ю., Тураева Ч.О. Использование проблемных методов обучения при изучении темы “Ароматические углеводороды”, International Conference on Advance Research in Humanities, Sciences and Education, Germany November 30, 2024
3. Ibodulloyeva, M.I., &Berdiyeva, M.I. (2022). The role of mathematics in chemistry. *Евразийский журнал права, финансов и прикладных наук*, *2*(8),13-17.
4. Ibodulloyeva M.I., Saydazimova G.A., Narzullayeva V.D. Kimyo fanini o‘qitishda o‘quvchilarning bilim faolligini rivojlantirish, “Tabiiy fanlar: yangi yondashuvlar va dolzarb tadqiqotlar” mavzusidagi xalqaro ilmiy-amaly konferensiya to‘plami. - Toshkent: TDPU, 2024.
5. Ibodulloyeva M.I., Turayeva Ch.O. “Siklik birikmalar” mavzusini o‘rganishda muammoli ta’lim metodlaridan foydalanish. “Ta’limni modernizatsiyalash sharoitida kimyo va uni o‘qitishdagi dolzarb masalalar: yutuqlar, muammo va yechimlar”, Respublika konf., T.: 2024
6. Mamadaliyeva N.I., Ibodullayeva M.I., Kamolova N.I., Kuchkarov M.A. Case Method and Its Use in Chemistry, Journal of Advanced Zoology, Volume 44 Issue S-5, JAZ INDIA Year 2023.