ACADEMICIA: An International Multidisciplinary Research Journal
ISSN: 2249-7137 Vol. 12, Issue 01, January 2022 SJIF 2021 = 7.492
A peer reviewed journal

FORMATION OF A SYSTEM OF CONCEPTS ABOUT A CHEMICAL REACTION AT THE LEVEL OF ELECTRONIC REPRESENTATIONS

Amanov R.A*; Masagutova D.S*

*Acting Associate Professor,
Department of Chemistry,
Tashkent State Pedagogical University named after Nizami.
UZBEKISTAN
Email id: ravshanamanov9@gmail.com

DOI: 10.5958/2249-7137.2022.00075.1

ABSTRACT

The article reveals the essence of this stage of training, which consists in clarifying the scope of the concept of "chemical reaction", deepening knowledge about the essence of a chemical phenomenon, explaining the regularities of a chemical reaction in the light of the theory of atomic structure, and the appearance of initial ideas about the mechanism of chemical transformation.

KEYWORDS: *System Of Concepts, Chemical Reaction, Electronic Representation, Chemical Bond, Halogens, Chemical Reaction Rate, Chemical Equilibrium, Classification Of Chemical Reactions, Metal*

INTRODUCTION

Educational activity includes: mastering knowledge systems and operating them, mastering systems of generalized and more specific actions, methods of educational work, ways of their transfer and finding - skills and abilities, the development of teaching motives, the formation of motivation and the meaning of the latter **[1, p.19].**

This stage of the formation of students' system of concepts about a chemical reaction is characterized primarily by the fact that there is a significant deepening of knowledge about the essence of chemical transformation and there is an opportunity to form initial concepts about its mechanism. The scope of the general concept of a chemical reaction is changing, since, on the one hand, it includes phenomena that do not represent transformations of some molecules into others (the formation, for example, of crystals with an ionic crystal lattice, ionic reactions in solutions), and on the other hand, nuclear reactions are excluded from it. Now, not every transformation of some substances into others should be considered a chemical reaction, and not every chemical phenomenon will represent the transformation of molecules of some substances into molecules of other substances.

In connection with the accumulation of chemical knowledge, there are also opportunities for generalizing concepts about the conditions of occurrence and flow of chemical reactions, about factors affecting the rate of chemical transformations. The basis is being created for the formation of concepts about the reversibility of chemical reactions and chemical equilibrium, about changing the direction of a chemical reaction when conditions change **[2, p.89].**

Mastering the theory of the structure of the atom makes it possible to use it at this stage for a deeper explanation of the various aspects of chemical transformation, and thereby deepening the relevant concepts and strengthening the links between them in the system under consideration.

Modern science considers the formation of a chemical bond as a process in which the total energy of a system of electrons and nuclei of interacting atoms decreases **[3, p.5].** In the topic "Chemical bonding. The structure of matter" examines the question of how, in the light of electronic representations, it is possible to explain the transformation of molecules of some substances into molecules of other substances. It turns out that this happens with the separation of electron pairs binding atoms and the emergence of new electron pairs. In the formation of substances with an ionic bond, the transition of electrons from one atom to another and the formation of a crystal lattice due to the electrostatic attraction of ions is added to this.

The ideas that students have about changes in chemical bonds between atoms allow them to give a new definition of the concept of a chemical reaction. To give this definition, make a table. In the first vertically arranged graph , three groups of phenomena are indicated: 1) physical (molecular); 2) chemical; 3) nuclear. For each of the groups, in the second column, it is noted whether the formation of new substances occurs with this phenomenon; in the third column, a change in chemical bonds; in the fourth, the transformation of atomic nuclei.

Based on the consideration of the phenomena indicated in the table, students give the following definition of the concept: A chemical reaction is a process in which new substances are formed, a chemical transformation occurs. Some chemical reactions require energy, usually in the form of heat; other chemical reactions occur with the release of heat. "A chemical reaction is a process in which new substances are formed, a chemical transformation occurs. Some chemical reactions require energy, usually in the form of heat; other chemical reactions occur with the release of heat."[**4, p.62].** This definition allows us to refer to chemical reactions processes that occur with the participation of substances that do not have an atomic-molecular structure.

After the introduction of a new definition of the concept of "chemical reaction", students' understanding of some laws of chemical interaction should also be deepened: preservation during chemical transformations of a chemical element and a mass of substances. This deepening is carried out by the students themselves when explaining these laws in the light of newly acquired knowledge.

The educational material of the topic about the natural family of halogens contributes to the development of students' ability to apply theoretical knowledge about the dependence of the properties of simple and complex substances on the characteristics of the elements forming them, on the structure of their atoms, the nature of chemical bonds in molecules and crystals **[5, p.135].** The study of the topic "Halogens" allows us to form the concept of the mechanism of a chemical reaction based on the consideration of the reaction of sodium with chlorine (ionic mechanism), hydrogen with chlorine (radical mechanism). At the same time, it is revealed that with an ionic mechanism, differently charged particles are formed during the reaction, in which all electrons are paired, and with a radical one, electron–neutral, but very active radical particles with unpaired electrons arise during the reaction.

In the same topic, using the consideration of the interaction of iodine with hydrogen, it is necessary to introduce an important idea for understanding the mechanism of chemical reactions

about the formation of an active complex during the reaction. In conclusion, a brief generalization of knowledge should be carried out, in which it is noted that the usual chemical equation does not show which intermediate transformations are carried out during a chemical reaction, and these transformations can be very diverse.

When studying halogens, students encounter two chemical reactions that occur under the influence of light: it excites an explosion of a mixture of chlorine and hydrogen and causes the gradual decomposition of silver chloride. The accumulation of this factual information, along with the previously acquired knowledge about the effect on chemical reactions of heating and the action of an electric discharge (explosion of a mixture of hydrogen and oxygen, conversion of oxygen into ozone), allows us to generalize knowledge about the relationship between reaction conditions and thermal effects. A table is compiled with the columns "Chemical reaction", "Thermal reaction effect", "Reaction conditions", "Duration of energy exposure", in which two examples of reactions are recorded, the conditions of which are the effect of heating, light, electrical discharges. Based on the analysis, students come to the conclusion: in the case of an endothermic reaction, any of the types of energy used must be supplied to substances all the time; in the case of an exothermic reaction, any of the types of energy used is necessary only for the beginning of chemical transformation.

When studying the actual material in the topics "Halogens", "Oxygen subgroup", students accumulate additional ideas about the influence of various conditions of the reaction flow on its speed, thereby preparing the basis for the subsequent generalization of knowledge about the speed of a chemical reaction. The place of generalization is determined by the need to give students this knowledge before forming the concept of chemical equilibrium and studying the production of sulfuric acid, i.e. at the end of the eighth grade course.

When generalizing knowledge about the laws of chemical reactions, students need to give an idea of the speed of a chemical reaction, once again pay attention to the dependence of this speed on the conditions of the reaction (concentrations of reacting substances, contact surface, temperature), consider the measure of influence on the speed of a chemical reaction of changes in the concentration of reacting substances (in accordance with the law of action of masses) and temperature, expand knowledge about catalysis and catalysts.

Generalization and development of concepts is carried out based on previously accumulated knowledge and on the discussion of experiments that allow comparing the rate of reactions in different conditions. The measure of the influence of these or other conditions is established using parallel experiments to find out how many times the rate of a chemical reaction increases with a particular change in the concentration of reagents and temperature.

Knowledge about the rate of chemical reactions only acquires the character of concepts when they are based on knowledge about the structure of matter and about the essence of a chemical reaction. Therefore, it is especially important not only to give students knowledge about the influence of conditions on the rate of chemical reactions, but also to consider why such influences take place.

Observations in the classroom and analysis of control written papers show that students easily explain the acceleration of the reaction with an increase in the concentration and contact surface of reacting substances. They explain these changes by an increase in the number of collisions of

molecules per unit of time. The situation is more complicated with the explanation of the effect that temperature rise has on the acceleration of the reaction. The teacher should tell you that when substances are heated, not only the number of collisions of molecules increases, but also the number of molecules that at the time of collisions can have increased energy - activation energy. For each reaction, the magnitude of this energy has its own value. To make it easier for students to consider the issue of activation energy, it is necessary to use schematic images of the energy barrier of various heights in the explanation.

In order to form concepts about chemical equilibrium, in addition to knowledge about the reaction rate, students must have an idea about the reversibility of chemical reactions. It arises on the basis of consideration of a number of inverse transformations, with which students began to get acquainted in the seventh grade.

The concept of reversibility of chemical reactions is formed when studying such reactions considered in the topic "Oxygen subgroup" as the formation of hydrogen sulfide from sulfur and hydrogen, the dissolution of sulfur oxide (IV) in water, and the concept of chemical equilibrium is based on the example of the transformation of sulfur oxide (IV) into sulfur oxide (VI). The conditions for the correct and successful formation of the concept of chemical equilibrium at this point of the course are: a) proof based on chemical experience that sulfur oxide (IV) does not completely turn into sulfur oxide (VI); b) emphasizing that even with very prolonged heating, this transformation cannot be achieved completely, since the reaction is reversible; c) consideration of changes in the speed of processes that occur in a closed tube with a catalyst, where a mixture of sulfur oxide (IV) with oxygen is placed; d) introduction of the definition of "chemical equilibrium"; checking with a number of questions and tasks how students understand this definition.

To consider the issue of shifting the chemical equilibrium, the composition of the equilibrium mixture is discussed and the question of how this composition can be made to meet the task of obtaining relatively large amounts of sulfur oxide (VI) is solved. The teacher notes that it is impossible to do this without changing the conditions in which the reaction is carried out. Then it turns out what conditions can cause an increase in the relative amount of sulfur oxide (IV) in the reacting mixture. Before considering the influence of temperature on the displacement of equilibrium, students should be informed that heating accelerates to a greater extent those reactions that occur with the absorption of heat.

Based on the consideration of the influence of changes in oxygen concentration and temperature on the equilibrium of $2SO_2 + O_2 \rightarrow 2SO_3 + Q$, the concept of a shift in chemical equilibrium is formed. Then it is fixed when solving a number of tasks.

Further development of the concepts of chemical equilibrium and its displacement under the influence of conditions is carried out in the IX class, the educational material of which is rich in examples of reversible reactions.

When studying the first topic of the IX class with students, it is necessary to find out whether electrolytic dissociation can be considered a chemical reaction. To this phenomenon, in relation to the change (break) of chemical bonds and the preservation of atomic nuclei, the previously introduced definition of the concept of "chemical reaction" is suitable. However, is it possible to consider the ions that appeared during electrolytic dissociation in solution as other substances

compared to the one that was dissociated? Consideration of the educational material on the properties of ions allows us to answer this question in the affirmative. Thus, electrolytic dissociation is a chemical reaction.

Further study of the topic allows us to find out that the electrolytic dissociation of weak electrolytes is a reversible process, which allows us to apply knowledge about the shift of chemical equilibrium to its consideration.

Knowledge about the essence of exchange reactions is being significantly deepened in this topic. These reactions are reduced to the binding of oppositely charged ions to form ionic crystals or molecules with covalent bonds. Along with considering the essence of exchange reactions, it is useful to draw students' attention to the signs, conditions, speed, direction of exchange reactions, fixing previously formed concepts in this regard.

In order to improve students' understanding of the classification of chemical reactions in the light of knowledge about the structure of matter, it is necessary to clearly link the division of chemical reactions into two groups (the first - without changing the degree of oxidation of chemical elements, the second - redox) with the types of chemical reactions already known to students. For this purpose, a table is compiled in which it is noted that chemical reactions that occur without changing the degree of oxidation of chemical elements include all exchange reactions, some compound reactions and decomposition. Chemical oxidation-reduction reactions should include all substitution reactions, some reactions of compound and decomposition. What is written in the table is explained by examples of chemical reactions, for which students compose equations and put down the oxidation states of chemical elements in the formulas of reacting substances.

The study of the topic "Nitrogen and phosphorus" introduces students to numerous examples of reversible reactions, the most important of which are the interactions of nitrogen with hydrogen, nitrogen with oxygen, ammonia with water, nitric oxide (IV) with water, nitric oxide (II) with oxygen. When studying the first of these interactions, students expand their knowledge about the influence of conditions on the displacement of chemical equilibrium, since the change in the direction of displacement with increasing and decreasing pressure is considered, general rules for the influence of pressure on the displacement of chemical equilibria are formed. In the same place of the course, in order to systematize knowledge, it is necessary to consider what conditions can shift the chemical equilibrium. Based on this, it is emphasized that the catalyst accelerates the forward and reverse reactions to the same extent, but cannot shift the equilibrium. At the same time, accelerating both opposite reactions, it contributes to a faster achievement of a state of chemical equilibrium.

When studying the chemical properties of ammonia, it is revealed that in the presence of a catalyst, the reaction between ammonia and oxygen proceeds with the formation of nitric oxide (II), and when ammonia burns in oxygen, nitrogen is formed. gorenje The influence of the catalyst on the change in the flow of the chemical reaction is explained by the fact that it accelerates mainly one of the possible directions of the reaction.

In the study of subsequent reversible reactions in the topics "Nitrogen and phosphorus", "Carbon and silicon", knowledge about chemical equilibrium and its displacement is being consolidated and specified. Discussion of the use of reversible reactions in the production of ammonia, nitric

acid should increase the practical significance of knowledge about chemical equilibrium and its displacement conditions. To develop students' ability to apply knowledge about chemical equilibrium and its displacement in solving chemical problems, at the end of the topic "Carbon and silicon", systematization and generalization of this knowledge should be carried out. For this purpose, a table is compiled with examples of reversible reactions and data on the direction in which certain chemical equilibria shift with changes in temperature or pressure.

When studying the topic "Metals", you should pay attention to the study of fundamentally new issues. These include the electrochemical series of metal stresses and the concepts of electrochemistry, water hardness and ways to eliminate it, as well as metallurgy **[6, p.125].** The study of the topic "Metals" provides an opportunity to expand students' knowledge about certain conditions of the flow of chemical reactions (the effect of electric current on solutions and melts of inorganic substances) and the results of chemical transformation (the occurrence of electric current). Electrolysis, on the one hand, and the appearance of current in a galvanic cell, on the other hand, are explained here on the basis of electronic representations.

Thus, at this stage of training, the scope of the concept of "chemical reaction" is clarified, knowledge about the essence of the chemical phenomenon was deepened, the regularities of the chemical reaction were explained in the light of the theory of the structure of the atom, initial ideas about the mechanism of chemical transformation appeared. At the same time, knowledge about the conditions of the occurrence and flow of chemical reactions has expanded, the concept of the rate of chemical reaction has been formed, knowledge has appeared about the extent to which concentrations of reacting substances and temperature affect this rate, the concepts of catalysis and catalyst have been enriched with ideas about the mechanism of the phenomenon and the influence of the catalyst on the direction of the chemical reaction, concepts of chemical equilibrium and its displacement have been formed.

REFERENCES

1. Alimova FA. Modern technologies in teaching chemistry. Tashkent; 2020. p.19.

2. Smirnova TV, Zueva MV, Savich TZ, Bochkovsky EV, Chertkov IN, Epstein DA, et al. General methods of teaching chemistry. Moscow; 1982. p.89.

3. Shelinsky GI. Chemical bond and its study in secondary school. Moscow; 1976. p.5

4. Godman A. Illustrated Chemical Dictionary. Moscow; 1988. p.62.

5. Koroshchenko AS. Teaching chemistry in the 7th grade. Moscow; 1988. p.135.

6. Zueva MV. Teaching chemistry in the 9th grade. Moscow; 1990. p125.