



METHODS OF TEACHING THE HISTORY OF THE DEVELOPMENT OF CHEMISTRY

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ABSTRACT

Chemistry is the science of the structure, properties and composition of substances. It studies both the processes of their transformation and the laws by which they are carried out. Man began to engage in activities based on the application of chemical processes long before our era. This happened at the time when people learnt to produce metals. Then the production of ceramics and glass, and the tanning of leather began to develop. Today, chemical plants and laboratories are widespread. Drying cabinets are widely used in them

As an initial stage in the development of science, we can mention the emergence of alchemy. It was based on the thoughts of Plato, Aristotle and Empedocles about nature and the mutual transformation of its elements. It is worth noting that alchemy was banned in the countries of Europe, but it remained popular until the beginning of the XVI century, when chemistry was separated into a separate discipline. This happened thanks to a scientist from Ireland, Robert Boyle. He also suggested that substances contain elements that cannot be decomposed.

At the end of the XVII-XVIII centuries, the "phlogiston theory" of chemist Stahl from Germany appeared. It explained the nature of combustion, oxidation and reduction of metals. However, it was recognised as erroneous. Physicist Lavoisier established the role of oxygen in these phenomena. It was his work that marked the stage later called the "chemical revolution".

The further period of chemistry development is associated with the formulation of its basic postulates. Thus, the law of conservation of mass of matter was discovered by M.V. Lomonosov in 1748. And in 1869 Russian scientist Mendeleev formulated the fundamental law of nature - the periodic law. At the end of XIX century radioactivity and electron were found, and at the beginning of the next century the theories of ionic and covalent bonding were developed, research in the field of quantum chemistry began. This made it possible to theorise Mendeleev's periodic law.

Since then, people have learnt to make predictions about the properties of various substances. In chemistry, physical and mathematical methods of research began to be widely used. This was necessary to make all sorts of calculations. Methods of analysis also appeared (vibrational and electron spectrometry, magnetochemistry, etc.), sample preparation was improved (for

example, drying cabinets were used for this purpose.

Practically every day everyone can observe how certain substances undergo various changes: an iron object under the influence of moisture becomes rusty, fallen leaves gradually decay, turning into humus, etc. The result of these changes is the appearance of new substances with completely different properties. Such processes are called chemical phenomena, in which other, new substances are formed from one substance, and the science that studies the transformation of substances is called chemistry.

The process of origin and formation of chemistry as a science was long in time, complex and contradictory in content. The origins of chemical knowledge lie in deep antiquity. They are based on the human need to obtain the necessary substances for their vital activity. For this purpose it was necessary to learn to produce from some substances other substances with given properties, i.e. to carry out their qualitative transformations.

The origin of the name "chemistry" is not clarified until now, although there are several versions on this issue. According to one of them, this name came from the Egyptian word "chemi", which meant Egypt, as well as "black". Historians of science translate this term also as "Egyptian art". Thus, in this version, the word chemistry means the art of producing necessary substances, including the art of turning ordinary metals into gold and silver or their alloys.

However, another explanation is currently more popular. A group of scientists believe that the word "chemistry" comes from the Greek term "chemos", which can be translated as "sap of plants". Therefore, "chemistry" means "the art of making sap", but the sap in question could also be molten metal. So chemistry can also mean "the art of metallurgy".

The history of chemistry shows that its development was uneven: periods of accumulation and systematisation of data from empirical experiments and observations were replaced by periods of discovery and vigorous discussion of fundamental laws and theories

In Ancient Egypt and Babylon, people mastered the art of metallurgy, studied the properties of various substances and searched for ways to transform them. Alchemists of the Middle Ages dreamed of turning ordinary metals into gold and finding the "philosopher's stone" - a substance that could grant immortality. Although many of these aspirations were naive, alchemists made significant contributions to the development of chemistry, especially in the development of new methods and tools.

In the 16th and 17th centuries, a new era in the history of chemistry began with the development of natural sciences. Robert Boyle, Antoine Lavoisier and many other scientists made key discoveries that laid the foundation for modern chemistry. Especially important was Lavoisier's recognition that the mass of a substance remains unchanged in a chemical reaction, which became the basis of the law of conservation of mass.

The 19th century was marked by a number of great discoveries in organic chemistry. Dmitri Mendeleev created the Periodic System of Elements, predicting the existence of elements that were not discovered until decades later.

In the early 20th century, a number of industrial corporations established the first industrial research laboratories. In the USA, the DuPont Chemical Laboratory was founded in 1903, and in 1925 the Bell Laboratory was established. After the discovery and synthesis of penicillin and then other antibiotics in the 1940s, large pharmaceutical companies appeared, employing professional chemists. The work in the field of chemistry of high-molecular compounds was of

great applied importance. One of its founders was German chemist Hermann Staudinger (1881-1965), who developed the theory of polymer structure. Intensive search for methods of obtaining linear polymers led in 1953 to the synthesis of polyethylene (Karl Ziegler, and then other polymers with specified properties. Today polymer production is the largest branch of the chemical industry.

Not all advances in chemistry have been good for humans. In the 19th century, hydrochloric acid and sulphur were used in the production of paints, soap, and textiles, which were very hazardous to the environment. In the 20th century, the production of many organic and inorganic materials increased due to recycling of used substances, as well as recycling of chemical waste, which posed a danger to human health and the environment.

At the beginning of the 20th century, the study of radioactivity began to receive special attention in chemistry. Maria Sklodowska-Curie and her husband Pierre Curie made revolutionary discoveries in this field, for which they were awarded the Nobel Prize. Their research laid the foundation for nuclear chemistry and physics.

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With the advent of quantum mechanics in the 20th century, chemistry gained a new tool for understanding atomic and molecular phenomena. Erwin Schrödinger and Werner Heisenberg contributed to the formation of quantum chemistry, which made it possible to predict and explain the behaviour of molecules at the atomic level.

After the Second World War, polymer chemistry was actively developed. The discovery and creation of polymer materials such as nylon, polyethylene and others was a real breakthrough in production and led to the creation of many household products that we use today.

In the 70s and 80s of the 20th century, environmental issues came to the forefront. Chemists began to actively seek solutions to environmental pollution problems, developing methods to purify water, air and soil from chemical pollutants.

With the development of biotechnology in the late 20th and early 21st century, chemistry began to actively co-operate with biology. This led to the discovery of new methods of treating diseases, the creation of genetically modified organisms and the development of new diagnostic methods at the molecular level.

Today, chemistry continues to evolve towards nanotechnology, quantum computing and green chemistry, with the goal of creating a sustainable and environmentally friendly future for all mankind.

Throughout its existence, chemistry has travelled from conjecture to precisely proven data. It has become one of the educational levels of modern man. Minimum knowledge is laid down from early childhood, and the simplest laboratories are located in every school.

Discoveries in chemistry provided the basis for the creation of pharmaceuticals. Millions of people are working to create drugs that can rid society of dangerous diseases and increase life expectancy. And who knows what other surprises chemistry has in store for us.

In the last century it was specially emphasised that "chemistry deals not with bodies but with substances" (D. I. Mendeleev), but now we are witnessing that the object of more and more attention of chemists is real macrobodies - the very mixtures, solutions, alloys, gases, with

which they directly deal in the laboratory and in production. According to K. Marx, the progress of chemistry "not only multiplies the number of useful substances, but also the number of useful applications of already known substances".

I want to give two interesting facts from the history of chemistry:

*The first human chemical laboratory was the fire. After burning clay in fire, it became strong and could be used to make simple utensils. Man learnt to cook food on fire. Here, by chance, he also got the first metals - copper, tin, lead, as well as glassware from seemingly ordinary stones. Thus appeared the first, as we now say, chemical crafts - pottery and metallurgy. About 7000 years ago man learned to smelt copper and make various products from it - tools, household items, weapons. This period in the history of ancient civilisation was called the Copper Age. By 4000 B.C. a new stage in the history of chemistry emerged, people learnt to smelt bronze - an alloy of copper and tin, which was much harder than copper. Bronze was immediately used for making swords, arrow and spearheads, and shields. The Bronze Age came. In the last millennium B.C. man mastered the method of making iron. This was a turning point in the history of metallurgy and in the history of society. Thus came the Iron Age, which actually lasted many hundreds of years.

*It is about the invention of so-called chemical weapons. The first effective gas attack was undertaken in April 1915 near the Belgian town of Ypres, where the Germans used chlorine released from cylinders against the British and French. On the attack front of 6 kilometres they installed 6 thousand gas cylinders filled with 180 tonnes of gas. For more than a week the Germans had to wait for a favourable wind. It blew in the right direction only at 5 p.m. on 22 April 1915. Within 5 minutes, the "gas batteries" released 168 tonnes of chlorine. The yellow-green cloud covered the French trenches, and under the effect of the gas fell mainly the soldiers of the division from the French colonies in Africa, which had just arrived at the front. Chlorine caused laryngeal spasms and pulmonary oedema. No means of defence against the gas in the troops were not yet available, no one even knew how to defend themselves and save themselves from such an attack. Therefore, soldiers who stayed in position were less affected than those who ran away, as every movement intensified the effects of the gas. Because chlorine is heavier than air and accumulated near the ground, those soldiers who stood under fire suffered less than those who lay or sat at the bottom of the trench. Those wounded lying on the ground or on stretchers and those moving to the rear along with the gas cloud suffered the most. In all, nearly 15,000 soldiers were poisoned, of whom about 5,000 died.

Today, chemistry continues to advance, enriching our understanding of the world at the molecular and atomic levels. It plays a key role in fields such as medicine, ecology, energy and many others, and continues to open new horizons for research and discovery.

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