

Inventors and Scientists: Dmitri Mendeleev

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TOP: Dmitri Mendeleev in 1897, public domain. BOTTOM: Mendeleev's 1869 periodic table. Images: Big History Project

Synopsis: Dmitri Mendeleev, a Russian chemist and teacher, devised the periodic table. It is a detailed system for organizing the chemical elements. These elements make up everything on Earth.

Organizing Matter

In the mid-1700s, chemists began to identify the building blocks of matter. Matter is anything with mass. Today we call them elements. Elements are made up of just one kind of atom. Gold and silver are elements.

Unlike compounds, they cannot be broken down more. Salt and water are both compounds.

At the time, scientists used many different symbols for elements. No one knew how elements related to each other. In 1869, the Russian chemist Dmitri Mendeleev changed that. He made a chart of elements. It became known as the periodic table.

Here's what is especially amazing: Mendeleev's chart left spaces for elements that had not yet been discovered. Later on, scientists discovered the elements Mendeleev predicted. It proved the brilliance of his periodic table.

A Difficult Childhood

Mendeleev was born in 1834 in Russia. He was the youngest of a dozen children. His family faced one crisis after another. When Dmitri was little, his father became blind. His mother worked in a glass factory, but it burned down. The family faced poverty.

But, Mendeleev's mother was determined that he get an education. She traveled with him a great distance so he could go to school. Ten days later, his mother died of tuberculosis. The lung disease had also killed his father. Mendeleev himself battled it as a young adult.

Mendeleev did not develop the periodic table all on his own. His work was built upon knowledge handed down by chemists before him. In the early 1800s, about 30 elements were known. Chemists then knew that some of these elements acted in similar ways. However, no one had found a pattern in their behaviors.

In 1860, many chemists had a meeting. Hydrogen is the lightest element. So they decided to give it a weight of 1. All other elements' weights would be compared with an atom of hydrogen. That means that if an element is eight times heavier than hydrogen, its weight is 8.

A Young Professor

The young Mendeleev became a professor. He had a quirky personality. He grew a flowing beard and long, wild hair that he cut only about once a year. Still, he became a popular professor.

Mendeleev knew there was no textbook on organic chemistry. Organic chemists study compounds containing the element carbon. All life depends on carbon. Mendeleev decided that he would write a textbook on organic chemistry.

Next, Mendeleev began another textbook. This one was for inorganic chemistry. Unlike organic chemistry, it is concerned with nonliving, inorganic substances. These include minerals.

In 1867, he set out to organize and explain the elements. He began with typical elements: hydrogen, oxygen, nitrogen, and carbon. Next, he included the halogens. Chlorine is a halogen. It is what keeps swimming pools clean.

At the time, elements were grouped in two ways. One way was by their atomic weight. Another was by their properties, such as whether they were metals or gases. Mendeleev had a breakthrough. The two ways of grouping elements could be combined.

A Missed Train And A Dream

Mendeleev was inspired by the card game Solitaire. In the game, cards are arranged two ways. They are arranged by suit. Suits are like diamonds or hearts. Then, they are arranged vertically by number. Mendeleev made up his own set of cards. Each represented one of the 63 elements known at the time. Mendeleev wrote the atomic weight and the properties of each element on a card.

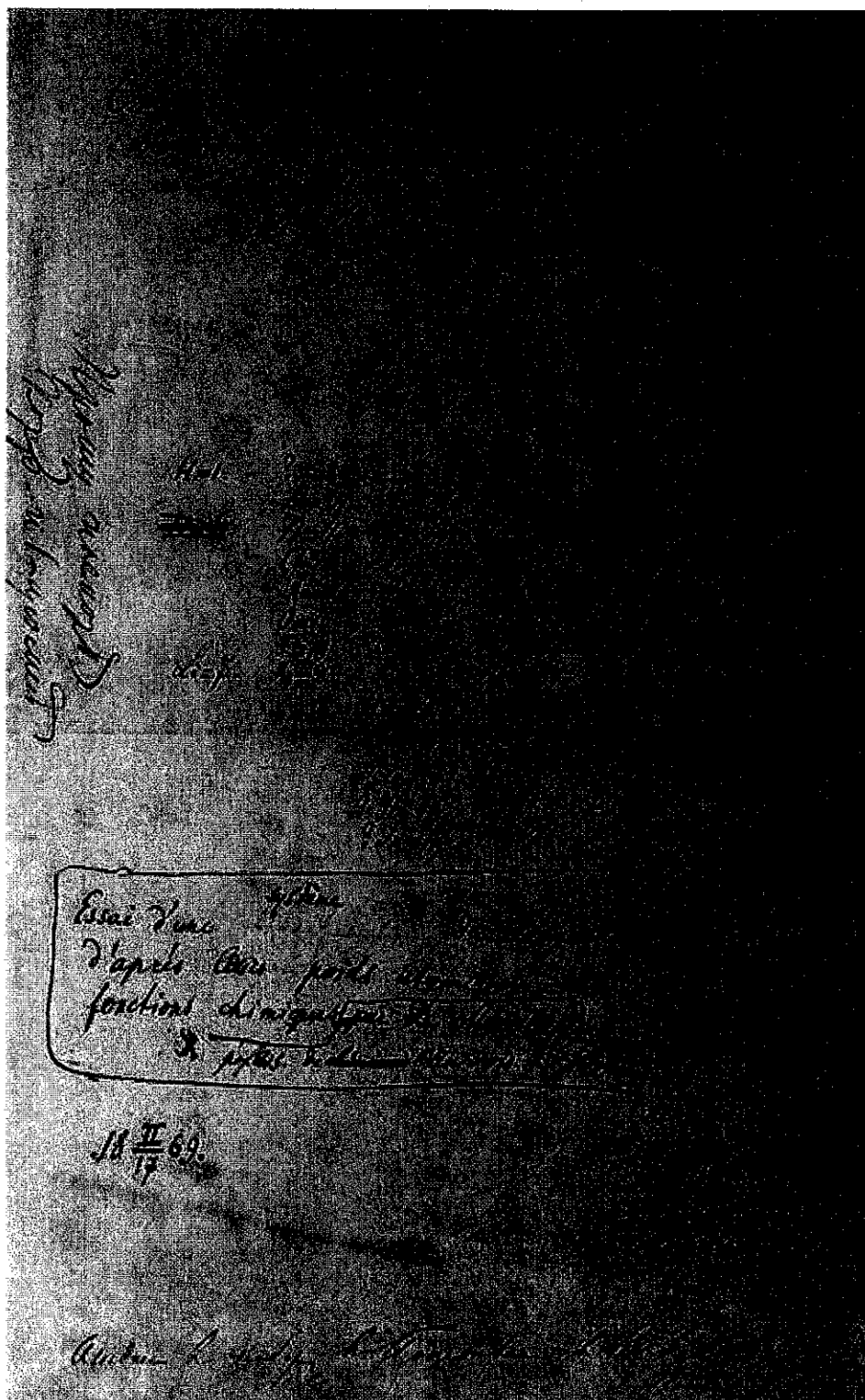
He took the cards everywhere he went. On February 17, 1869, he had to catch a train. But Mendeleev was busy organizing his cards. He carried on for three days. He arranged and rearranged the cards in different orders. He forgot to get on the train.

Mendeleev was tired from his three-day effort. He fell asleep. Later, he recalled: "I saw in a dream, a table, where all the elements fell into place as required. Awakening, I immediately wrote it down on a piece of paper." He named his discovery the "periodic table of the elements."

While arranging these cards, Mendeleev discovered what is called the Periodic Law. Mendeleev arranged the elements in order of atomic mass. He noticed that the properties were repeated. The properties on his chart repeated themselves regularly, or periodically. That is how it became known as the periodic table.

Put In Order Of Increasing "Atomic Number"

Mendeleev had actually placed the elements in order of increasing "atomic number." This number represents the amount of positively charged protons in the atom. It is also the number of negatively charged electrons that orbit the atom.



Mendeleev went even further. He used the patterns in his table to predict the atomic mass and atomic number of the elements he thought must exist. He left blank spaces in his chart for them.

Within 15 years, three more elements were discovered. Amazingly, they fit on Mendeleev's table.

A New Standard

The elements are arranged in rows called "periods." Elements with similar properties appear in vertical columns. Each vertical column is a group of elements. This instantly shows one set of relationships when read up and down. You see another when reading from side to side.

Some groups have elements sharing very similar properties, such as their behavior. For example, each element has its own melting point, the temperature at which it changes from a solid to a liquid. Each has a boiling point where it goes from a liquid to a gas. Scientists can guess how an element will react by seeing where it is on the table.

The elements are known by a symbol of letters. For example, the atomic symbol for gold is "Au." Its atomic number is 79. The higher the atomic number, the "heavier" an element is.

Hydrogen is 1 on the periodic table, in the upper left corner. Its atomic number is 1. Hydrogen's nucleus contains one proton and one electron. About 98 percent of the Universe consists of the two lightest elements, hydrogen and helium.

To Make Chemistry Clear

The periodic table left plenty of room for discovery. Helium, the second-most common element in the Universe, was not found on Earth until 1895. Another 60 or so elements have since been discovered. Others have been invented by humans. Some might still be found.

Mendeleev's mission to make chemistry clear lives on.

Quiz

- 1 Which sentence BEST states the main idea of the article?
- (A) The periodic table that Russian professor Dmitri Mendeleev made left room for helium, a very common element.
 - (B) A Russian professor named Dmitri Mendeleev wrote the most important textbook for inorganic chemistry.
 - (C) A Russian professor named Dmitri Mendeleev organized and explained the relationships between the elements.
 - (D) Russian professor Dmitri Mendeleev made up a set of cards to represent each of the 63 elements that were known at the time.
- 2 Which of the following sentences about Dimitri Mendeleev is MOST important to include in a summary of the article?
- (A) He was the youngest of a dozen children.
 - (B) Next, he included the halogens.
 - (C) On February 17, 1869, he had to catch a train.
 - (D) He named his discovery the "periodic table of the elements."
- 3 Which of these sections of the article BEST explains how Mendeleev first got the idea for developing the periodic table?
- (A) the introduction [paragraphs 1-3]
 - (B) "A difficult childhood"
 - (C) "A young professor"
 - (D) "A missed train and a dream"
- 4 Based on the section "Put in order of increasing atomic number," which of the following statements is TRUE?
- (A) Every time a new element was discovered, Mendeleev had to create a completely new periodic table.
 - (B) When Mendeleev created the periodic table, he believed that more elements would be discovered some day.
 - (C) When Mendeleev created the periodic table, he first placed the elements in order of decreasing atomic mass.
 - (D) The atomic mass and atomic number of an element was of little interest to Mendeleev when he created the period table.