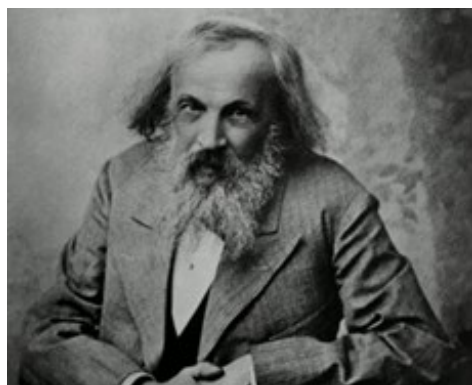


2.6 How are the Elements Organized? (1.6)

Objectives

- Describe the method Mendeleev used to make his periodic table.
- List the advantages and disadvantages Mendeleev's table had over other methods of organizing the elements.
- Explain how our current periodic table differs from Mendeleev's original table.

Mendeleev Organized His Table According to Chemical Behavior



Dmitri Mendeleev created the first periodic table in 1869.

By 1869, a total of 63 elements had been discovered. As the number of known elements grew, scientists began to recognize patterns in the way chemicals reacted and began to devise ways to classify the elements. Dmitri Mendeleev, a Siberian-born Russian chemist, was one of the first scientists to make a **periodic table** - (a tabular arrangement of the chemical elements) much like the one we use today.

The reason we call this table a “periodic” table is that the properties of elements (such as atomic radius or melting point) repeat periodically as their atomic numbers increase.

Mendeleev's table listed the elements in order of increasing atomic mass. Then he placed elements underneath other elements with similar chemical behavior. For example, lithium is a shiny metal, soft enough to be cut with a spoon. It reacts readily with oxygen and reacts violently with water.

When lithium reacts with water, it produces hydrogen gas and lithium hydroxide. As we proceed through the elements with increasing mass, we will come to the element sodium. Sodium is a shiny metal, soft enough to be cut with a spoon. It reacts readily with oxygen and reacts violently with water. When it reacts with water, it produces hydrogen gas and sodium hydroxide. You should note that the description of the chemical behavior of sodium is very similar to the chemical description of lithium. When Mendeleev found an element whose chemistry was very similar to a previous element, he placed it below the similar element.

Short videos on early periodic table:

- <http://go.uen.org/b6k>
- <http://go.uen.org/b6l>
- <http://go.uen.org/b6m>

Changes to our Modern Periodic Table

The **periodic table** we use today is similar to the one developed by Mendeleev, but is not exactly the same. There are some important distinctions: For example, Mendeleev's table did not include any of the noble gases, which were discovered later. Other elements were also discovered and put into their places on the periodic table.

As previously noted, Mendeleev organized elements in order of increasing atomic mass, with some problems in the order of masses. In 1914 Henry Moseley found a relationship between an element's X-ray wavelength and its atomic number, and therefore organized the table by nuclear charge (or atomic number) rather than atomic weight. Thus Moseley placed argon (atomic number 18) before potassium (atomic number 19) based on their X-ray wavelengths, despite the fact that argon has a greater atomic weight (39.9) than potassium (39.1). The new order agrees with the chemical properties of these elements, since argon is a noble gas and potassium an alkali metal. Similarly, Moseley placed cobalt before nickel, and was able to explain that tellurium should be placed before iodine, not because of an error in measuring the mass of the elements (as Mendeleev suggested), but because tellurium had a lower atomic number than iodine.

Moseley's research also showed that there were gaps in his table at atomic numbers 43 and 61 which are now known to be technetium and promethium, respectively, both radioactive and not naturally occurring. Following in the footsteps of Dmitri Mendeleev, Henry Moseley also predicted new elements.

The modern periodic table is organized in order of increasing atomic number. When the elements are arranged this way, we see a periodic repetition of their chemical and physical properties.

Mendeleev placed the elements in their positions according to their chemical behavior. Thus, the vertical columns in Mendeleev's table were composed of elements with similar chemistry. These vertical columns are called groups or families of elements. The modern periodic table, organized by atomic number, agrees with Mendeleev's observations and places similar elements in groups or families.

A great interactive periodic table can be found at: www.webelements.com

Summary

- The periodic table in its present form was organized by Dmitri Mendeleev.
- Mendeleev organized the elements in order of increasing atomic mass and in groups of similar chemical behavior. He also left holes for missing elements and used the patterns of his table to make predictions of properties of these undiscovered elements.
- The modern periodic table now arranges elements in order of increasing atomic number. Additionally, more groups and elements have been added as they have been discovered.