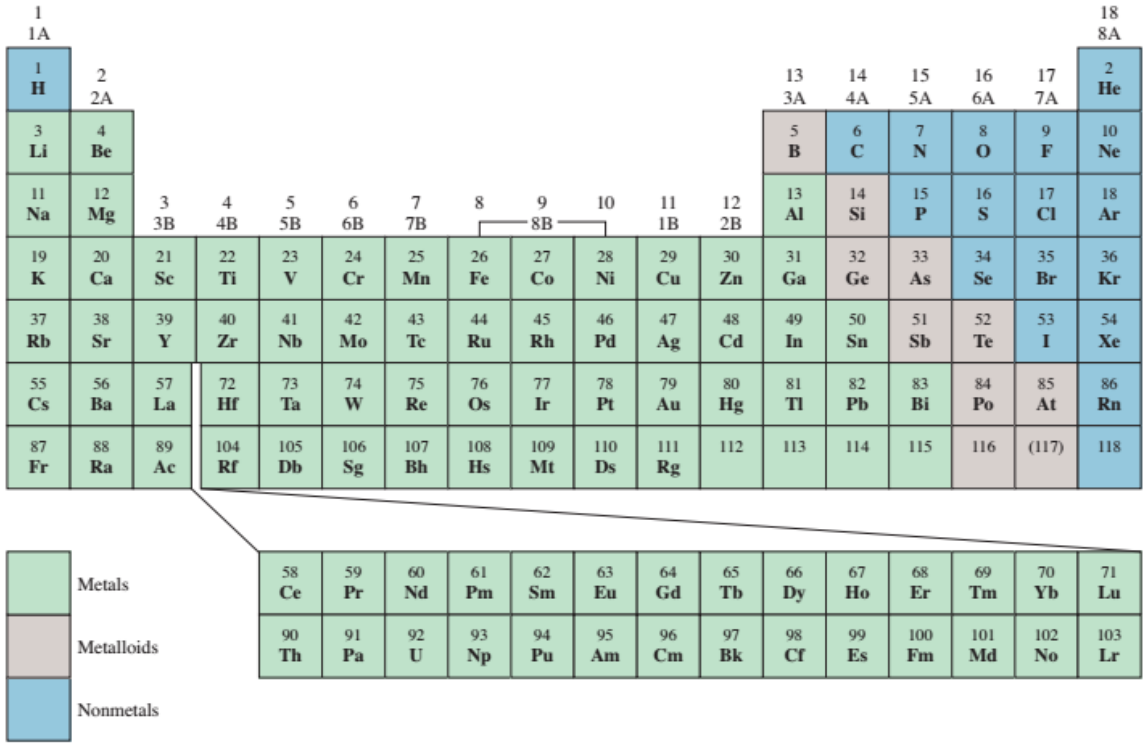
Introduction to the Periodic Table

References : 1. General Chemistry- principles and modern applications (Petrucci, Herring, Madura, Bissonnette)
2. Chemistry-10th Edition (Raymond Chang)

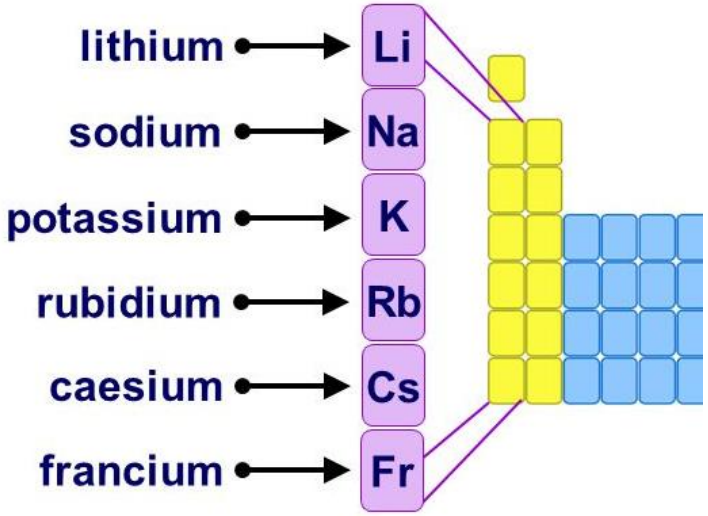
- More than half of the elements known today were discovered between 1800 and 1900. During this period, chemists noted that many elements show strong similarities to one another. Recognition of periodic regularities in physical and chemical behavior and the need to organize the large volume of available information about the structure and properties of elemental substances led to the development of the ***periodic table,*** *a chart in which elements having similar chemical and physical properties are grouped together.*
- Figure shows the modern periodic table in which the elements are arranged by atomic number (shown above the element symbol) in *horizontal rows* called ***periods*** and in *vertical columns* known as ***groups*** or ***families,*** according to similarities in their chemical properties. Note that elements 112–116 and 118 have recently been synthesized, although they have not yet been named.



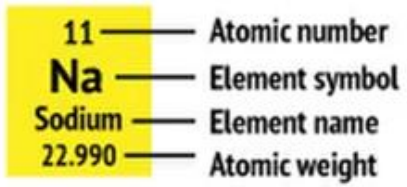
In 1869, Dmitri Mendeleev and Lothar Meyer independently proposed the periodic law:
When the elements are arranged in order of increasing atomic mass, certain sets of properties recur periodically.

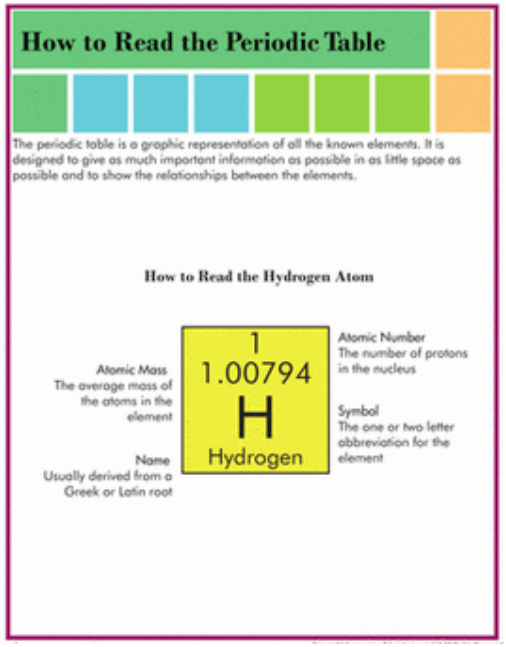
Features of the Periodic Table

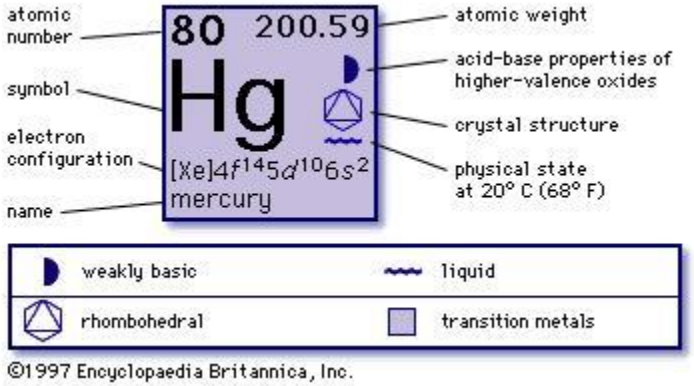
- In the periodic table, elements are listed according to increasing atomic number starting at the upper left and arranged in a series of horizontal rows.
- This arrangement places similar elements in vertical groups or families.
- For example, sodium and potassium are found together in a group labeled 1 (called the alkali metals). We should expect other members of the group, such as cesium and rubidium, to have properties similar to sodium and potassium. Chlorine is found at the other end of the table in a group labeled 17.



- Each element is listed in the periodic table by placing its symbol in the middle of a box in the table. The atomic number (Z) of the element is shown above the symbol, and the weighted-average atomic mass of the element is shown below its symbol.
- Some periodic tables provide other information, such as density and melting point, but the atomic number and atomic mass are generally sufficient for our needs. Elements with atomic masses in parentheses, such as plutonium, Pu (244), are produced synthetically, and the number shown is the mass number of the most stable isotope.

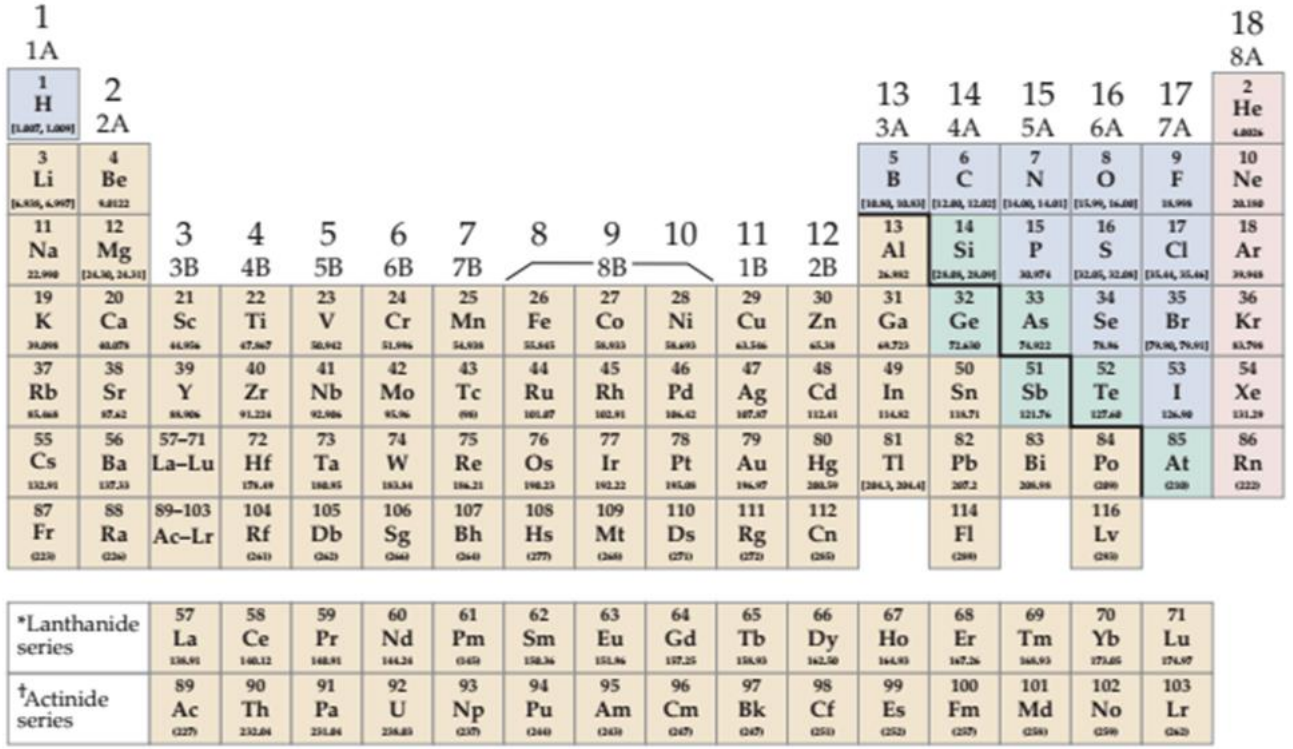






- It is customary also to divide the elements into two broad categories—metals and nonmetals. In Figure, colored backgrounds are used to distinguish the metals (tan) from the nonmetals (blue and pink). Except for mercury, a liquid, metals are solids at room temperature. They are generally malleable (capable of being flattened into thin sheets), ductile (capable of being drawn into fine wires), good conductors of heat and electricity, and have a lustrous or shiny appearance.

- The properties of nonmetals are generally opposite those of metals; for example, nonmetals are poor conductors of heat and electricity. Several of the nonmetals, such as nitrogen, oxygen, and chlorine, are gases at room temperature. Some, such as silicon and sulfur, are brittle solids. One—bromine—is a liquid.
- Two other highlighted categories in Figure are a special group of nonmetals known as the noble gases (pink), and a small group of elements, often called metalloids (green), that have some metallic and some nonmetallic properties.



Periodic Variation in Physical Properties