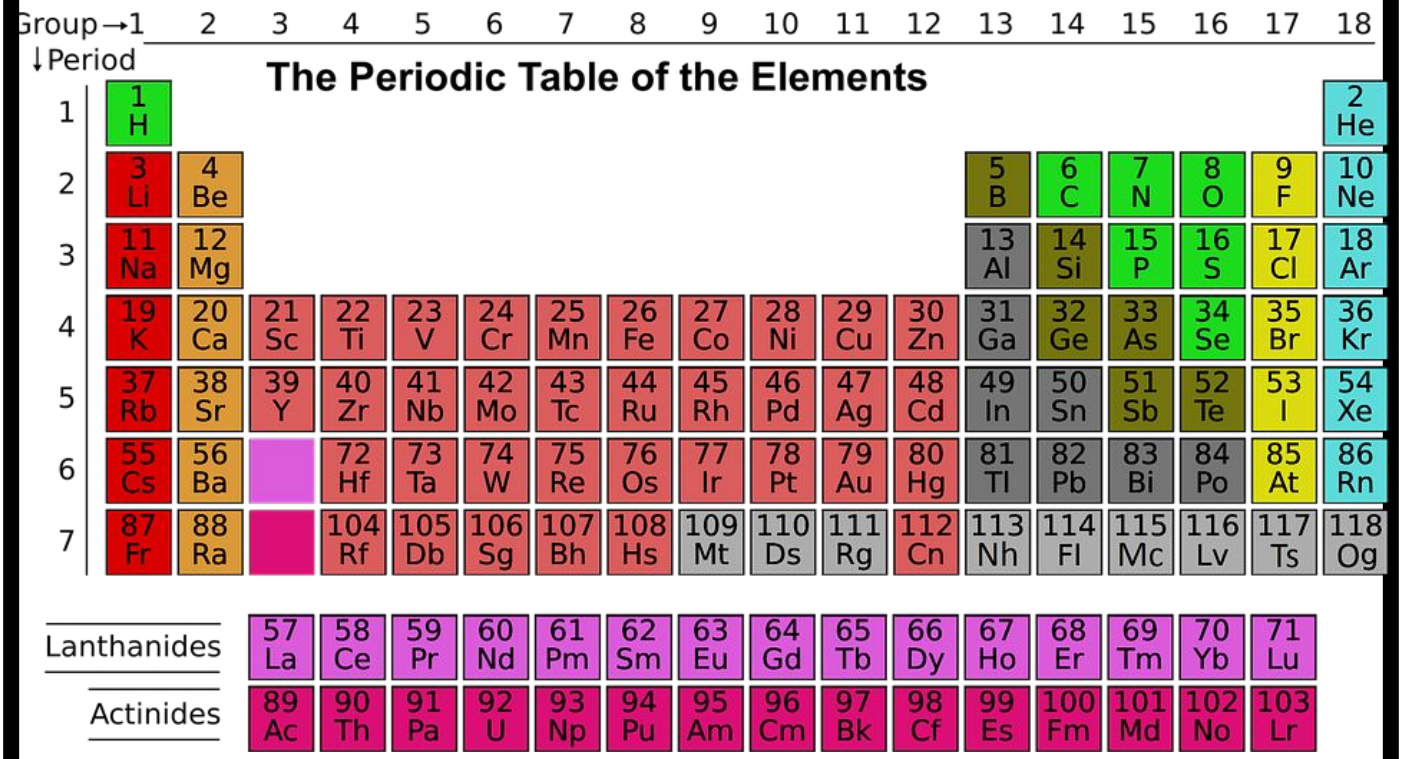
Periodic Table



The periodic table of elements, simply known as the periodic table, is a two-dimensional chart of the chemical elements. The elements are organized by atomic number, electron configuration, and other periodic patterns based on the elements' chemical properties.

General Information

- The periodic table is a display of the chemical elements.
- Chemical elements are materials that cannot be broken down through chemical methods.
- As of 2019, there are 118 identified chemical elements.
- 94 of these elements occur naturally. The other 24 were synthesized in laboratories.
- The elements are arranged in columns (called groups), rows (called periods), and specific rectangular areas (called blocks).
- The elements are also arranged according to atomic number, electron configuration, ionization energy, electronegativity, electron affinity, and metallic character.

Periodic Table

Brief History of the Periodic Table

- French chemist Antoine-Laurent de Lavoisier came up with the first list of chemical elements in 1789. It had 33 elements in total.
- In the following century, chemists continued to research and observe relationships of the elements and develop one scheme that unites these relationships.
- In 1829, German chemist Johann Wolfgang Döbereiner discovered that the elements can be grouped into triads based on their chemical properties, which became known as the Law of Triads.

Antoine-Laurent de Lavoisier

- In 1843, German chemist Leopold Gmelin produced a table of 55 elements which is one of the foundations of our modern periodic table.
- In 1857, French chemist Jean-Baptiste Dumas described relationships between groups of metals in his published work.
- In 1862, French geologist Alexandre-Emile Beguyer de Chancourtois published the “telluric screw” which is a three-dimensional arrangement of the elements.
- In 1864, German chemist Julius Lothar Meyer published a table with 28 elements while English chemist William Odling published a table of 57 elements.
- From 1863 to 1866, English chemist John Newlands wrote a series of papers explaining similar properties of elements recurring at intervals of eight, which became known as the Law of Octaves.

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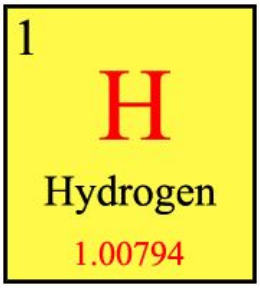
- In 1871, Russian Chemist Dmitri Mendeleev published a new edition of his periodic table with similar elements grouped in columns rather than in rows.
- By the 1930s, the popular version of the periodic table attributed to Horace G. Deming was being circulated in American schools.
- The periodic table we use now is based on Mendeleev's structure.

Reading An Element

- The parts included in the element's label depends on the version of the periodic table, but these are the basics:
  - Symbol - an abbreviation of the chemical element's name. It is usually one or two letters.
  - Name - the common name of the element. It is found below the symbol.
  - Atomic number - the number of protons in the atom's nucleus. It is found above the symbol.
  - Atomic mass - the mass of an atom. It is expressed in atomic mass units. It is found below the name.



Arrangement

- The arrangement of chemical elements can provide insight about the relationships of the elements with each other.
- The organization of elements can also predict properties of unknown or newly discovered elements.
- There are seven rows (periods), 18 columns (groups), and four blocks in the periodic table.
- Groups are numbered from 1 (leftmost column) to 18 (rightmost column).

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- The blocks are labelled the s-block, f-block, d-block, and p-block.
- The elements are also grouped into metals, metalloids, and nonmetals.

Chemical Properties

- Electron configuration is the distribution of electrons in atomic or molecular orbitals.
- Ionization energy is the energy needed to remove electrons from a neutral atom resulting in a positively charged ion.
- Electronegativity is a measure of the strength of atoms in attracting shared pair of electrons to themselves.
- Electron affinity is a measure of a neutral atom's strength of gaining an electron.

Metallic Character

- Metallic character is defined by the degree of reactivity of a metal.
- Metals are elements that effectively conduct heat and electricity. Metals easily lose electrons and form positive ions (cations).
- Nonmetals are elements that cannot conduct heat or electricity. Nonmetals are not flexible and lustrous.
- Metalloids are elements that show mixed properties of metals and nonmetals.
- Metalloids are boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te), polonium (Po), and astatine (At).

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Periodic Trends

- Elements in the same period exhibit trends in atomic radius, ionization energy, electronegativity, and electron affinity.
  - Atomic radius increases from right to left.
  - Ionization energy increases from left to right.
  - Electronegativity increases left to right.
  - Electron affinity increases from left to right.
- Elements in the same group show a trend in properties, such as electronegativity and ionization energy, with increasing atomic number:
  - Atomic radius decreases from top to bottom.
  - Ionization energy increases from bottom to top.
  - Electronegativity increases from bottom to top.
- Blocks are grouped according to the sequence in which the electron shells of the elements are filled.
- Generally, metals are on the left and nonmetals on the right.