Periodic classification

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I. Periodicity

The periodic table is the most significant tool that chemists use for organizing and recalling chemical facts.

The arrangement of elements having same properties in the same group and separating them from elements with different properties is called classification of elements.

In the first attempt Mendeleev and Meyer arranged the elements in order of increasing atomic weight.

Modern periodic table is the result of the discovery of the atomic number by Moseley in 1914. in which the elements are arranged in order of their increasing atomic number. The elements having similar properties are repeated after regular intervals. The modern periodic table contains seven horizontal rows called periods and eighteen vertical columns called groups.

I.1. groups

- The group number of a main-group element is equal to the number of valence electrons for that element.

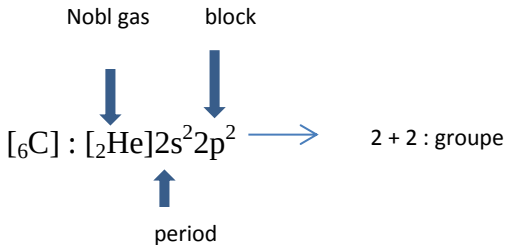
I.2. periods

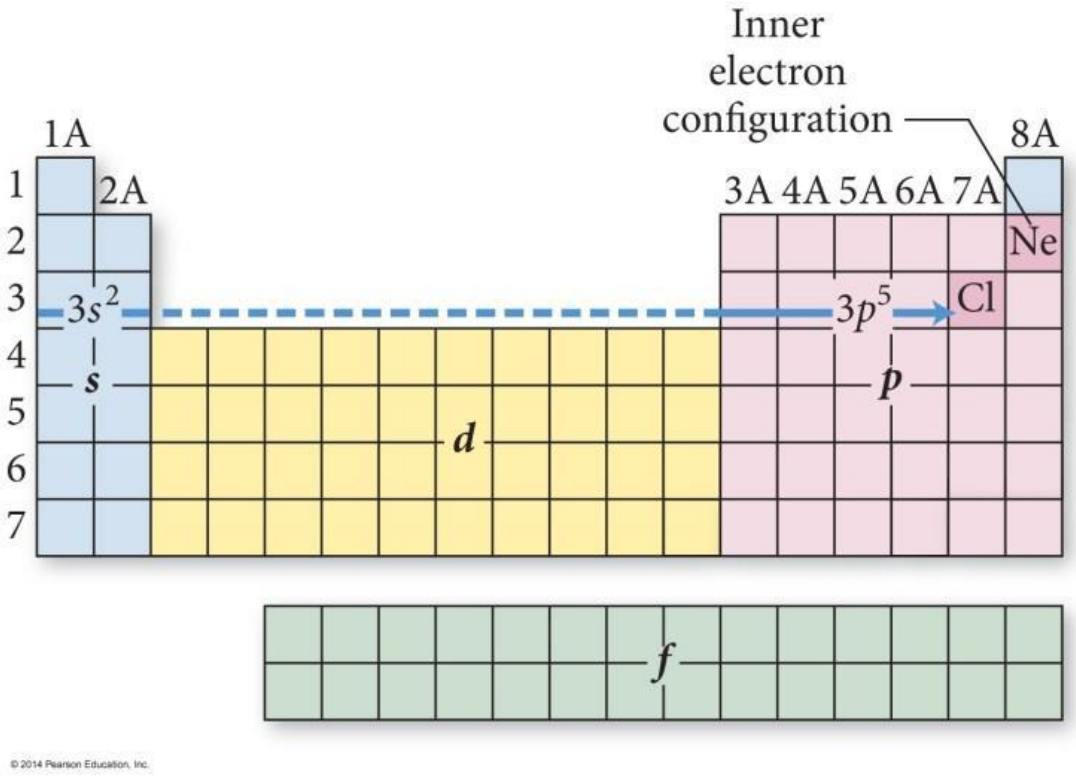
- The row number of a main-group element is equal to the highest principal quantum number (n) for that element.

The elements in the long form of periodic table are classified into four blocks. They are s, p, d and f-block elements. The classification is based on the name of orbitals which receive the last electron. In which :

The A-groups comprise s- and p-elements, whereas the B-groups consist of d- and f-elements.

Example :

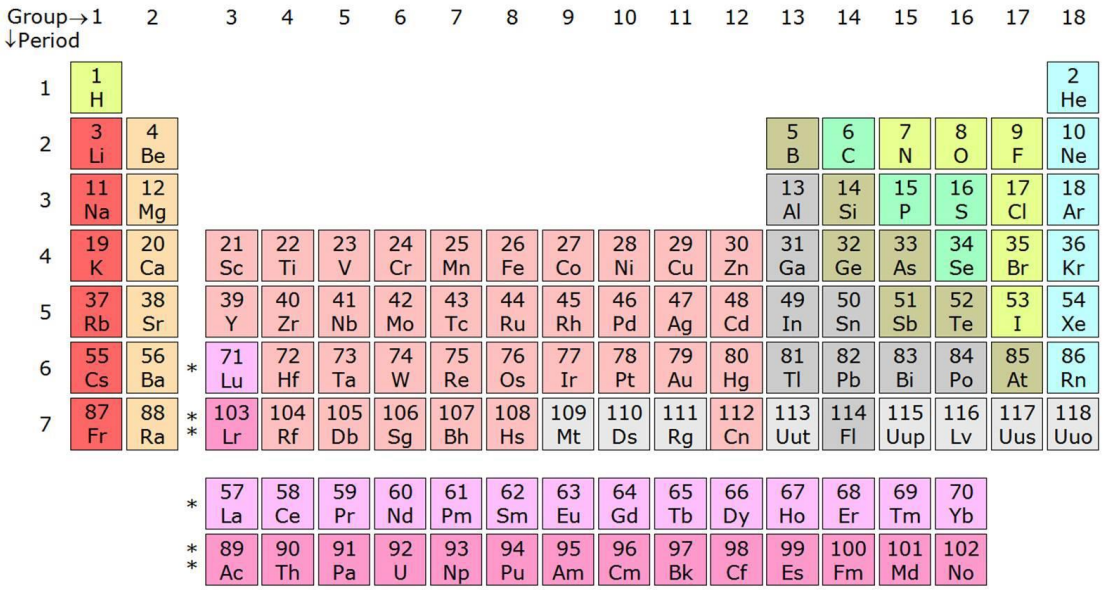




There are eighteen vertical columns known as groups in the modern periodic table which are arranged from left to right and seven horizontal rows which are known as periods.

column	**outermost usb-shells**	**block**	**Group number**	**Group name**	**Property**
Column 1	ns^1	s	Group IA	Alkali metals	They form strong alkalis with water
Column 2	ns^2	S	Group IIA	Alkaline earth	They also form alkalis but weaker than group 1 elements
Column 13	ns^2np^1	p	Group IIIA	Boron family	Boron is the first member of this family
Column 14	ns^2np^2	P	Group IVA	Carbon family	Carbon is the first member of this property
Column 15	ns^2np^3	p	Group VA	Nitrogen family	This group has non-metals and metalloids
Column 16	ns^2np^4	p	Group VIA	Oxygen family	They are also known as chalcogens

Column 17	ns^2np^5	p	Group VIIA	Halogen family	The elements of this group form salts.
Column 18	ns^2np^6	p	Group VIIIA	Zero group	They are noble gases and under normal conditions they are inert.
Columns 3	$ns^2(n-1)d^1$	d	IIIB, , , , ,	the transition elements	Important for living organisms(i.e. as minerals)
Column 4	$ns^2(n-1)d^2$	d	IVB		
Column 5	$ns^2(n-1)d^3$	d	VB		
Column 6	$ns^1(n-1)d^5$	d	VIB		
Columns 7	$ns^2(n-1)d^5$	d	VIIB		
Columns : 8, 9 and 10	$ns^2(n-1)d^6$, $ns^2(n-1)d^7$, $ns^2(n-1)d^8$	d	VIIIB		
Column 11	$ns^1(n-1)d^{10}$	d	IB		
Column 12	$ns^2(n-1)d^{10}$	d	IIB		
Block f	$6s^24f^{1-14}$	f		Lanthanides	Part of the "inner transition metals" ●Soft silvery metals ● Z = 57 to 70
	$7s^25f^{1-14}$	f		Actinides	Radioactive elements ●Part of the "inner transition metals" ●Z = 89 to 102



II. Periodic properties

Horizontal& vertical trends can be seen in the elements for:

- ✓ atomic radius
- ✓ ionization energy
- ✓ electronegativity

II.1. Atomic radius

GROUP TREND: Atomic radius increases as you move from **top to bottom** in a family. This is because major energy levels (1-7) are being filled with more and more electrons. The electrons get farther & farther from the nucleus.

PERIOD TREND: Atomic radius generally decreases from **left to right** as atomic number increases. This is because extra electrons are entering the same level while the nucleus gets larger & more positive. This draws the electron cloud in towards the nucleus.

II.2. Ionization energy

Ionization energy is the energy needed to remove an electron from an atom.

GROUP TREND: In vertical groups, ionization energy decreases from **top to bottom**. This is because electrons are farther from the nucleus & filled levels cause a shielding effect.

SHIELDING EFFECT: Inner electrons shield outer electrons from the positive nucleus. This means outer electrons are not held as tightly.

PERIOD TREND: Ionization energy tends to increase as you move from **left to right** toward the noble gases. This is because metals tend to lose electrons & nonmetals tend to gain electrons. All of them want to as stable as the noble gases.

II.3. Electronegativity

Electronegativity is the measured tendency to attract an electron in a chemical bond.

GROUP TREND: Electronegativity decreases from the **top to bottom**. Smaller atoms have a shorter distance to the nucleus & less shielding effect.

PERIOD TREND: Electronegativity values increase as you go from **left to right**. Metals want to empty their sublevels so they lose electrons. Nonmetals want to gain electrons so they can be like the noble gases.