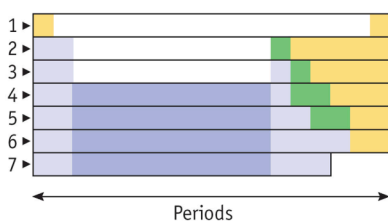


THE PERIODIC TABLE OF ELEMENTS

Dmitri Mendeleev (1834-1907): A Russian chemist attempted to organize the elements based on information such as density, appearance, atomic mass, and melting point. After much work he determined that there was a **repeating pattern** to the properties when the elements were arranged in order of increasing atomic mass. In this order, certain chemical properties of the elements were "**periodic**" meaning that they had a regular repeated pattern. There were still some missing elements, but he predicted that those were elements yet to be discovered. In 1914 Henry Moseley determined that the elements should be arranged by the number of **protons** - the **atomic number**- and the periodic table was rearranged using this method, which greatly improved the arrangement of elements. So, we arrive at the modern version of the periodic table which looks like...

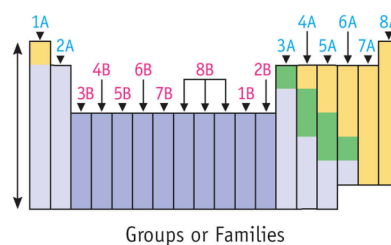
You've got your Periods...

- Periods = **rows**
- From left to right
- What do elements in a row have in common?
 - the same number of **electron shells**
- Every element in Period 1 (1st row) has 1 shell for its electrons (H & He)
- All of the elements in period 2 have 2 shells for their electrons.
- It continues like this all the way down the table



And you've got your Groups

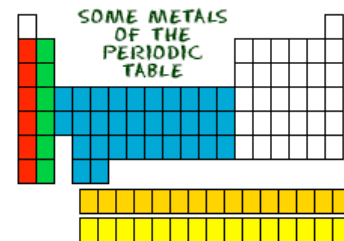
- Column = **group** = **families**
- What do elements in a group have in common?
 - The same number of **valence electrons** (electrons in the outer shell)
- Every element in group 1 (1st column) has 1 valence electron
- Every element in group 2 has 2 valence electrons.
- In fact, if you know the group's number, you automatically know how many valence electrons it has!



Group Labels: Labeling the groups can be confusing because the rules change with the middle transition elements. The transition elements get grouped together as the "B" elements, or groups #1B - 8B. All of the other elements are "A" elements, with groups #1A - 8A. Using this labeling system will tell you exactly how many valence electrons are in the atoms. However, sometimes the groups are just labeled #1-18.

Two at the Top: **Hydrogen** (H) and **helium** (He) are special elements. Hydrogen can have the talents and electrons of two groups, one and seven & sometime it is missing an electron, and sometimes it has an extra. Helium is different from all of the other elements. It can only have two electrons in its outer shell. Even though it only has two, it is still grouped with elements that have eight (inert gases).

Metals, Metalloids, & Nonmetals: Another pattern we find on the periodic table is that all of the metals are grouped together on the left & the nonmetals are on the right. The metalloids fall in between, near the zigzag line. This trend isn't a coincidence. The number of **valence electrons**, or electrons in the outer shell, determines how an element acts. For example, metals have **few** electrons in their outer shell. This causes them to possess metallic properties such as, conductivity & reactivity. Conversely, the nonmetals on the right of the periodic table have **almost** complete sets of electrons in their outer level. Therefore, they possess nonmetallic traits such as dullness, poor conductivity, and brittleness. We can summarize all of this just by saying: Elements get **less** metallic as you move from left to right.



Families Stick Together: Scientists group families of elements by their **chemical properties**. Each family reacts a different way with the outside world. BUT, elements within a family are similar to one another. Metals behave differently than gases and there are even different types of metals. Some don't react, others are very reactive, and some are metallic. Let's go over the periodic table families...

Family #1 or 1A: Alkali Metals

- Li, Na, K, Rb, Cs, Fr
- **Very** Reactive
- **1** valence electron
- All have ONE outer electron to lose.
- This makes them highly reactive, since they are looking to combine with another element to become stable and have that outer level filled and complete (or happy!).
- Most reactive of all metals
- Soft and can be cut with a knife

Family #2 or 2A: Alkaline Earth Metals

- Be, Mg, Ca, Sr, Ba, Ra
- **very** reactive, but less than alkali metals
- **2** valence electrons
- Not as reactive because it is harder to give two electrons away than just one.
- Sodium is used in street lights, and different compounds are used in detergent, paper, glass & soap.
- Potassium is used in fertilizer and with chloride. Potassium chloride is used as a salt substitute.
- Typically what's lost in perspiration

Family #3-12 (1B-8B): Transition Metals

- 1-2 valence electrons
- Less reactive than alkaline earth metals because they don't give away their electrons as easily
- In these "short families" the properties are very much alike.
- Most have high melting points and are hard.
- They all have 1 or 2 properties like the alkali or alkaline earth families.
- Group 11 = The Copper Family: are the coinage metals (Cu, Ag, Au) used to make \$\$\$\$\$
- Lanthanide Series:
 - 15 elements that start with lanthanum (La) at atomic number 57 and finishing up with lutetium (Lu) at number 71
 - shiny reactive metals
 - Most found in nature
- Actinides Series:
 - 15 elements that start with actinium (Ac) at atomic number 89 and finishing up with lawrencium (Lr) at number 103.
 - radioactive and unstable
 - Most are man-made & not stable in nature

#14 or 4A: Carbon Family

- C, Si, Ge, Sn, Pb
- 1 metal, 1 metalloid, and 2 nonmetals.
- 4 valence electrons
- No other group has a greater range of properties.
- They have the unique ability to form chainlike compounds.
- This family is incredibly important in the field of technology.

#15 or 5A: Nitrogen Family

- N, P, As, Sb, Bi
- 2 nonmetals, 2 metalloids, 1 metal
- 5 valence electrons
- Reactivity varies

#16 or 6A: Oxygen Family

- O, S, Se, Te, Po
- 3 nonmetals, 1 metalloid, 1 metal
- 6 valence electrons
- reactive
- Most members form covalent compounds,
- Must share 2 electrons with other elements to form compounds.
- Oxygen is one of the most reactive nonmetallic elements.

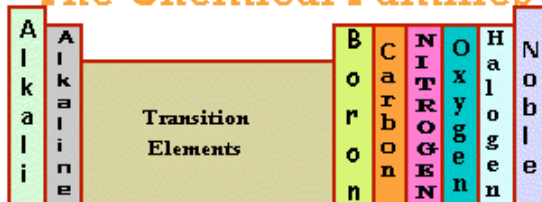
Family #18 or 8A: Noble Gases

- He, Ne, Ar, Kr, Xe
- Nonmetals
- NON REACTIVE gases
- NO bonding with other elements
- 8 valence electrons (except He which only has 2)
- With the exception of He, these elements have 8 electrons in their outer energy level.
- Very stable
- They are inert, meaning they don't react with anything.
- Why? Because they're happy! All of these elements have full outer shells
- Colorless, odorless gases at room temperature
- Often used in neon products/neon lights
- All are found in Earth's atmosphere
- Only in laboratories can scientists force these to bond with other elements.

Family #17 or 7A: Halogens

- F, Cl, Br, I, At
- These are very reactive
- nonmetals
- 7 valence electrons
- They are very reactive because have 7 valence electrons, this means they are ALMOST full and can combine with many elements.
- Halogen elements combine with metals to form compounds called salts.
- Halogen means "salt-producer".
- They combine with a metal by ionic bonding.
- They are the most reactive of the nonmetals families.
- As you move down the column, the elements get less reactive.
- A halide is when a halogen combines with another element (NaCl)

The Chemical Families



The Lanthanoid Series

The Actinoid Series