Warm-Up

1. What is the periodic table?
2. Who invented it?
3. How does the periodic table organize the elements?
4. Why did Mendeleev leave empty spaces when he constructed his periodic table?

Chemistry Notes: The Periodic Table

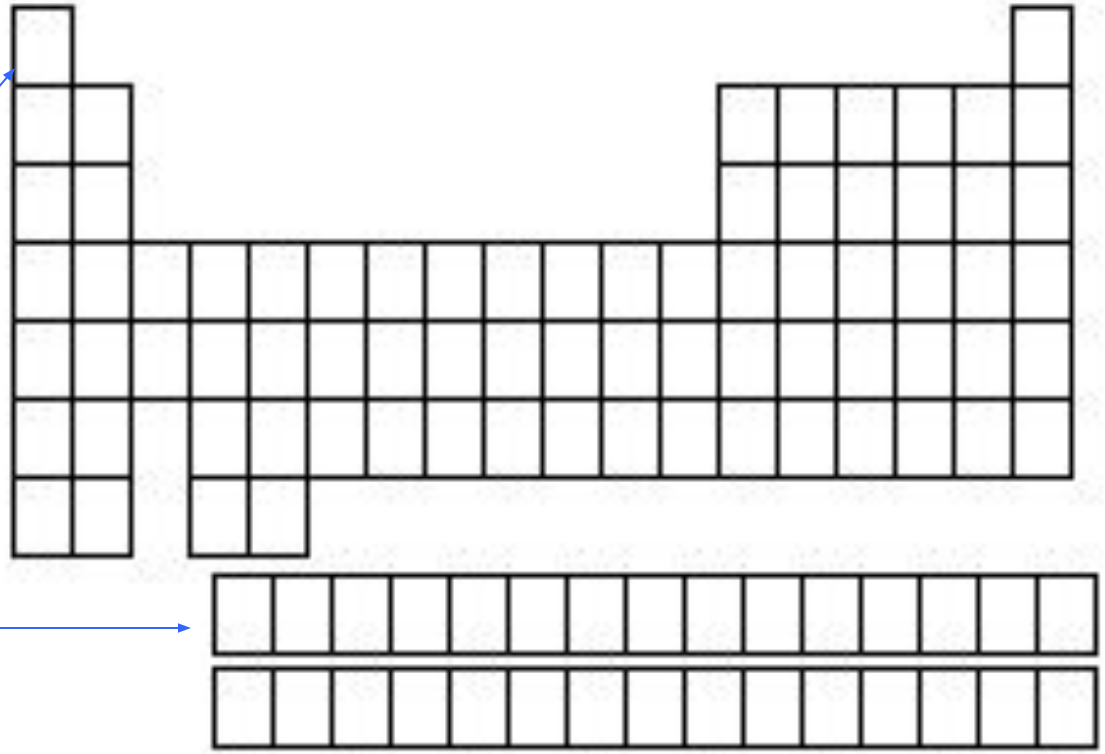
Every element has its own unique symbol.

- For some elements the symbol is simply the first letter of the element's name.
  - Examples: Hydrogen = H, Sulfur = S, Carbon = C
- Symbols for other elements use the first letter plus one other letter of the element's name. The first letter is CAPITALIZED and the second letter is not.
  - Examples: Aluminum = Al, Platinum = Pt, cadmium = Cd
- The origins of some symbols are not as obvious. Some elements have symbols that refer to the element's name in latin.
  - Examples: gold = Au, lead = Pb, copper = Cu

The Father of the Periodic Table—Dimitri Mendeleev

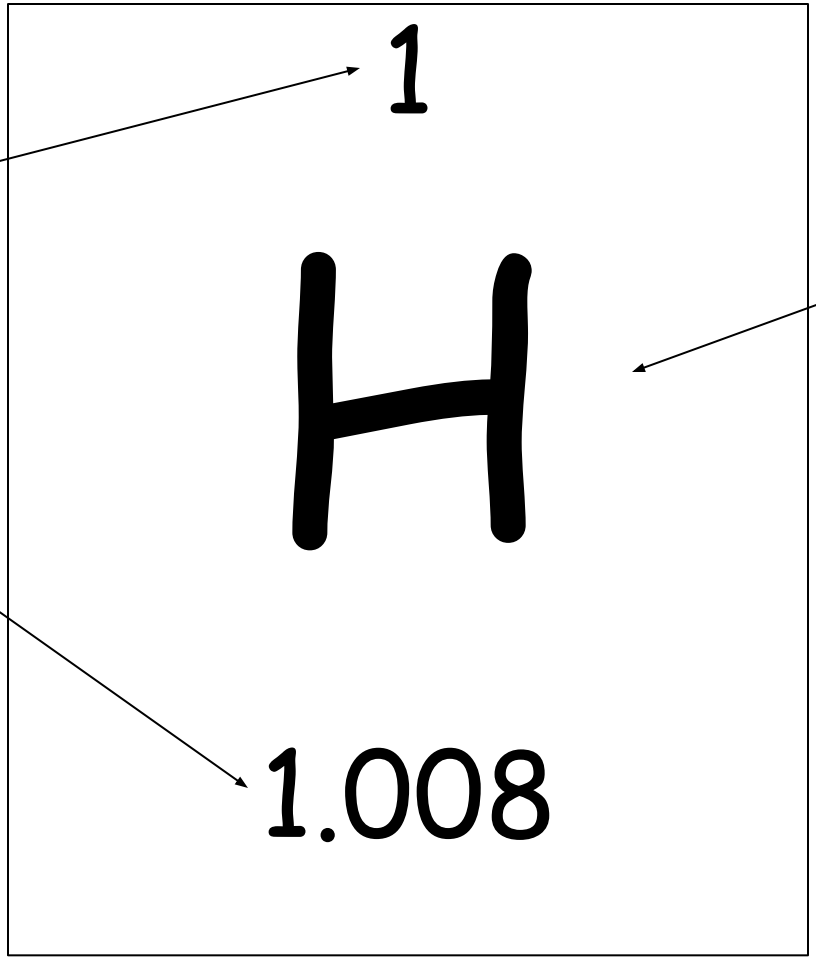
- Mendeleev was the first scientist to notice the relationship between the elements
  - Arranged his periodic table by atomic mass
  - Said properties of unknown elements could be predicted by the properties of elements around the missing element
  - Predicted Aluminum (Al)
- It was later discovered that the periodic nature of the elements was associated with **atomic number**, not atomic mass
  - Periodic means patterns

The Periodic Table



- Column (up and down)= Group or Family
- 18 columns on the Periodic Table
- Row (side to side)= Period
- 7 rows on the Periodic Table

What does the information in the box tell me?



Atomic Number = # of protons

Elemental Symbol

Atomic Mass = actual mass of the atom

*if you round, you get Atomic mass Number (# of protons plus neutrons)

Types of Elements: Metals

- On the left side of the periodic table
- Properties:
  - Good conductors of electricity and heat
  - Shiny in appearance (metallic!)
  - Malleable: able to be molded or re-shaped
  - Ductile: able to be stretched into wire or hammered very thin (think: Aluminum foil)
  - These are general properties; individual properties of metals will vary. Some will be better conductors or more ductile than others!

Types of Elements: Nonmetals

- Elements on the right side of the periodic table.
- Properties are opposite those of metals.
  - Usually poor conductors of heat and electricity
  - Not shiny, malleable, or ductile
- Most are gases

Types of Elements: Metalloids

- Found touching the "stair-step line" (see next slide)
- Have properties of both metals and non-metals.
- Most common metalloid is silicon, which is the second most common element in the Earth's crust.

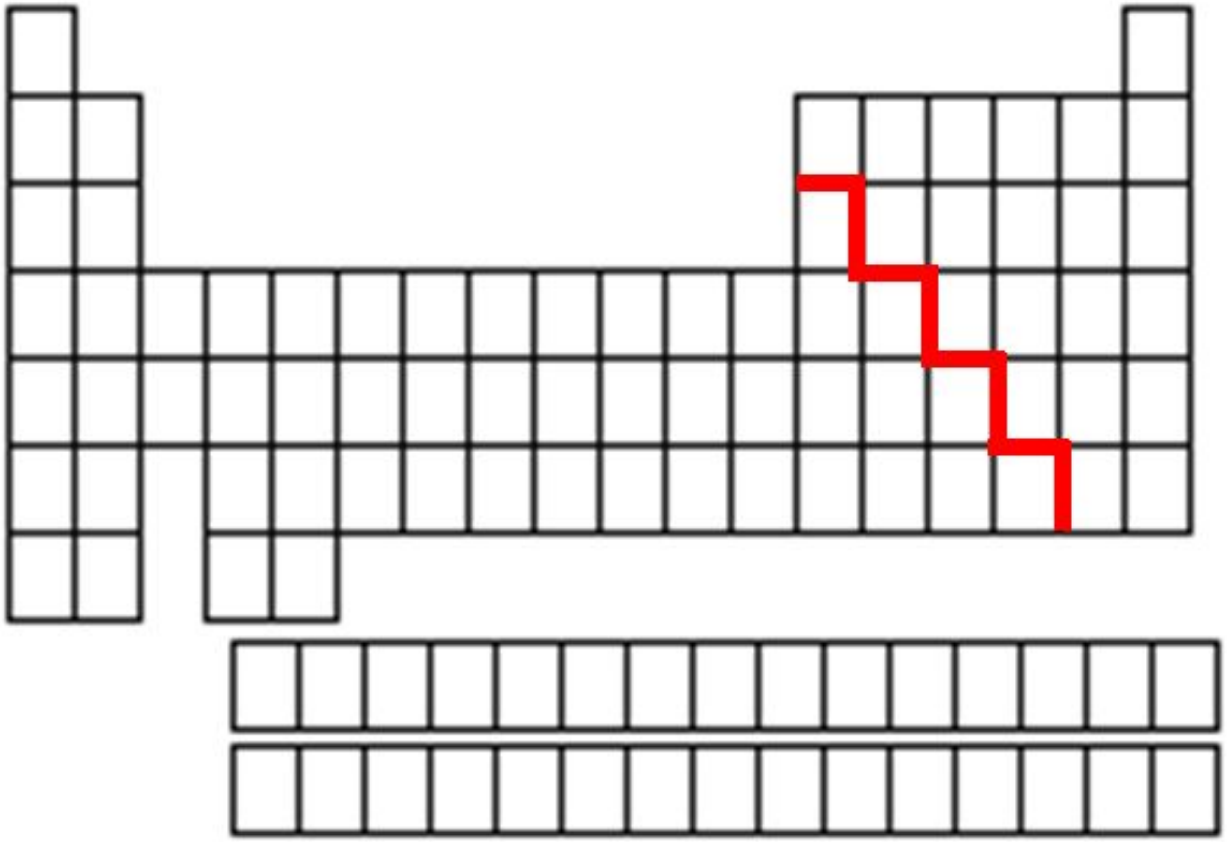
Metals, Nonmetals, and Metalloids

•Only <u>nonmetal</u> on the metal side

•Nonmetals are on the <u>right</u> of the stair-step

•Metals are to the <u>left</u> of the stair-step

•Metalloids <u>touch</u> the stair-step

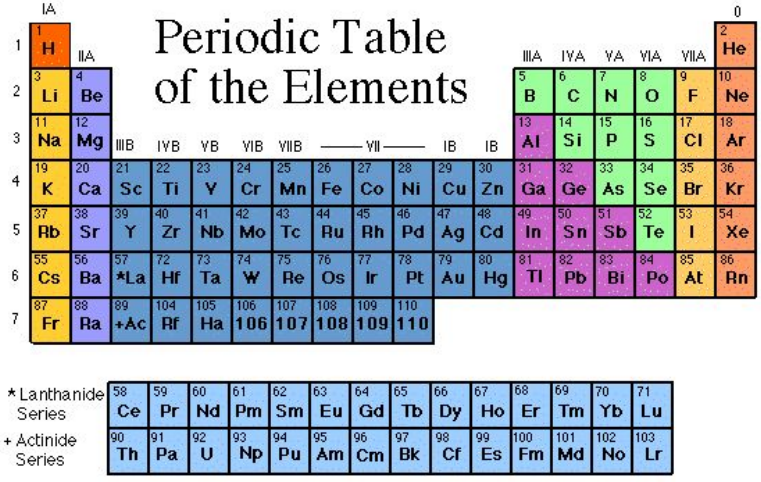


Valence Electrons and Reactivity

- Valence electrons are the electrons farthest from the nucleus. Atoms have different numbers of valence electrons.
- Reactivity: how likely an atom is to interact (react) with other atoms. Some elements are very reactive, while others almost never react.

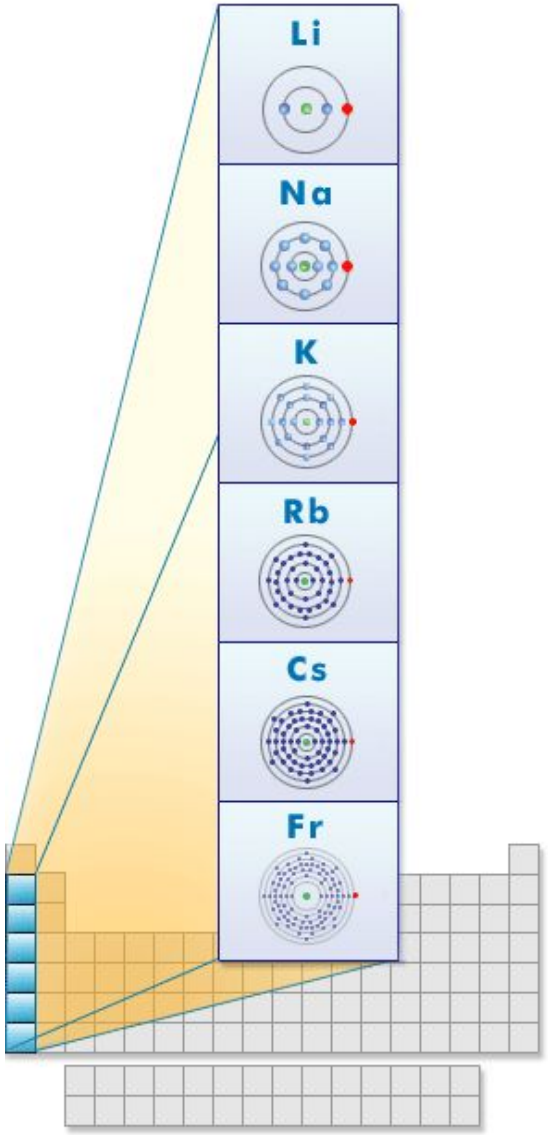
The Groups/Families of the Periodic Table

- Elements on the periodic table can be grouped into <u>families</u> (or groups) based on their **<u>chemical</u>** properties.
  - We call them "families" because the elements in each family are "<u>related</u>."
- Each family has a **<u>specific name</u>** to differentiate it from the other families in the periodic table.
- Elements in each family **<u>react</u>** differently with other elements.



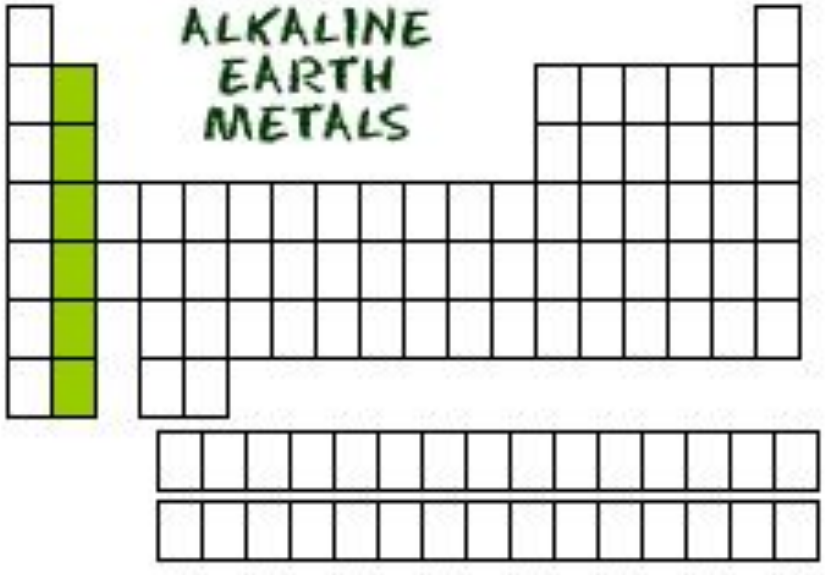
Group 1: the Alkali Metals

- Hydrogen is NOT part of this family!!!
- Most reactive metals on the PT
  - Reactive: how likely an atom is to interact with other atoms
- Rarely found free (by themselves) in nature
- Form ions with a charge of +1, have 1 valence electron
- Soft and silvery, shiny
- *Very* reactive, esp. with water
- Conduct electricity



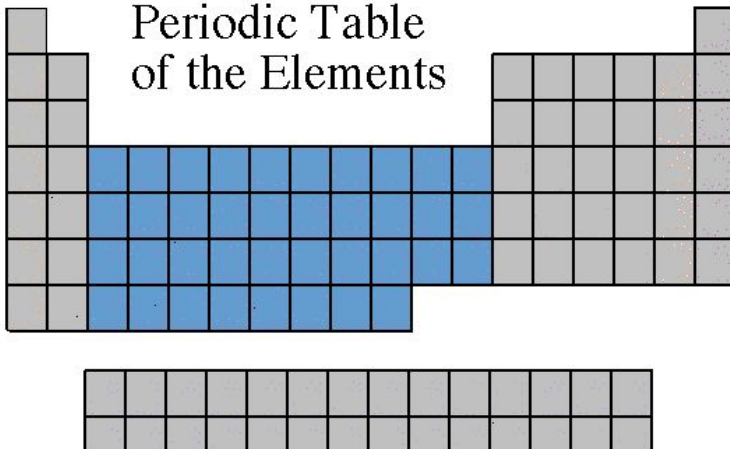
Group 2: the Alkaline Earth Metals

- Still quite reactive
- Form ions with a charge of +2, have 2 valence electrons
- White, silvery, and malleable
- Conduct electricity



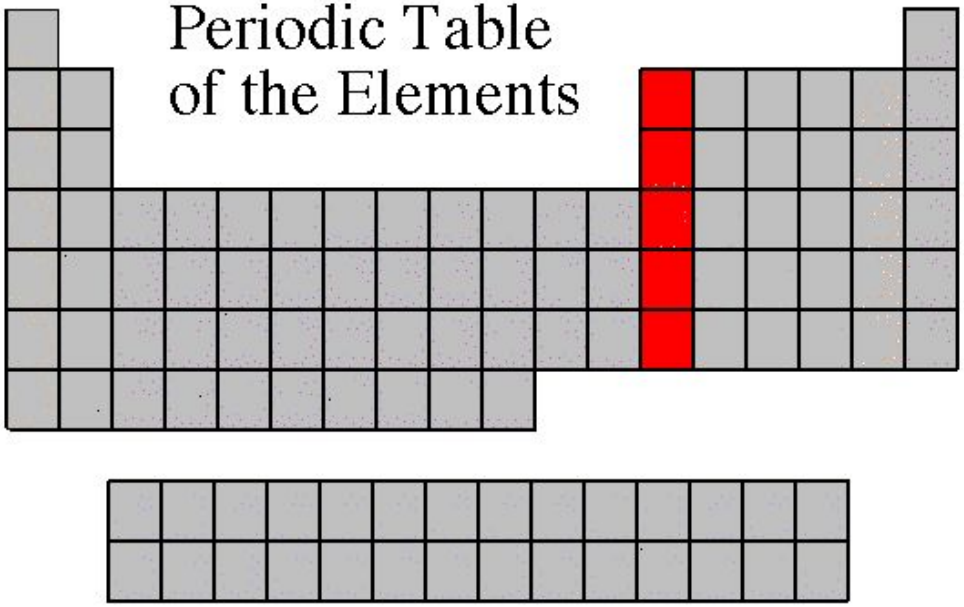
Groups 3-12: Transition Metals

- Found freely and in compounds in nature
- Form ions with a charge of usually +2 but can vary—usually 2 valence electrons
- Almost all are solids at room temp (except Mercury, Hg, is a liquid)
- Good conductors of heat and electricity.



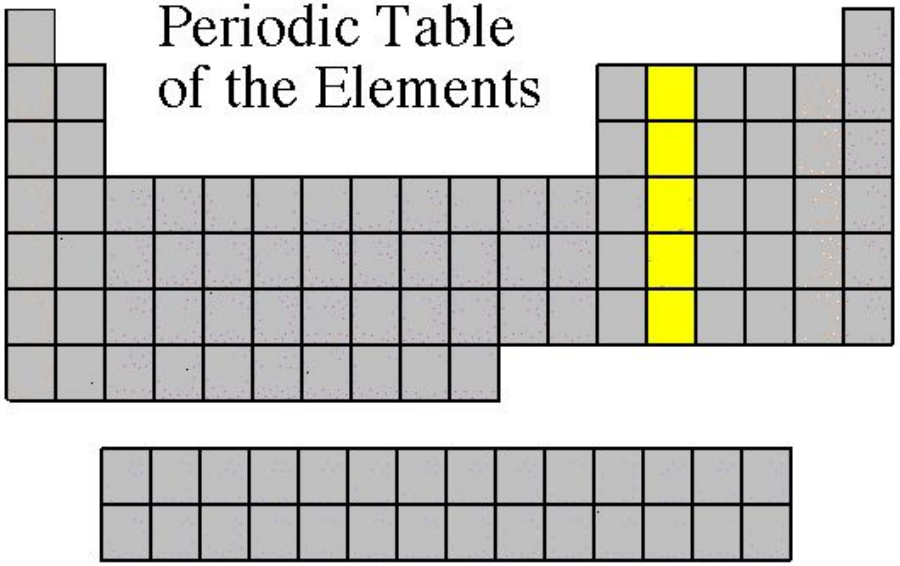
Group 13: Boron Family

- Named after the first element in the group (at the top of the column), Boron
- Form ions with a charge of +3, have 3 valence electrons



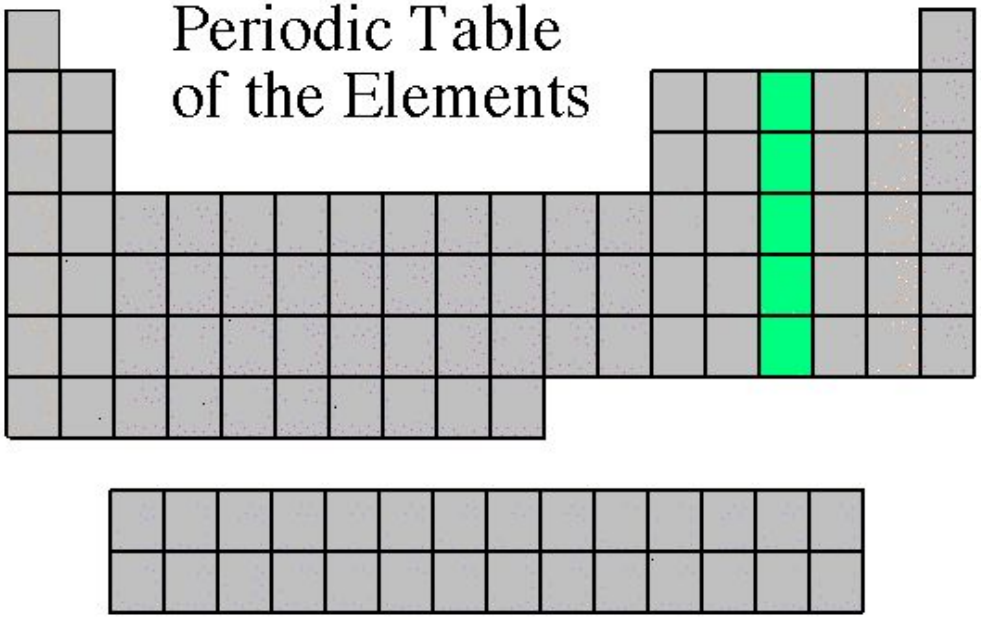
Group 14: The Carbon Family

- Contains elements that can form unusual bonds (carbon and silicon)
- Form ions with a charge of +4 or -4, have 4 valence electrons



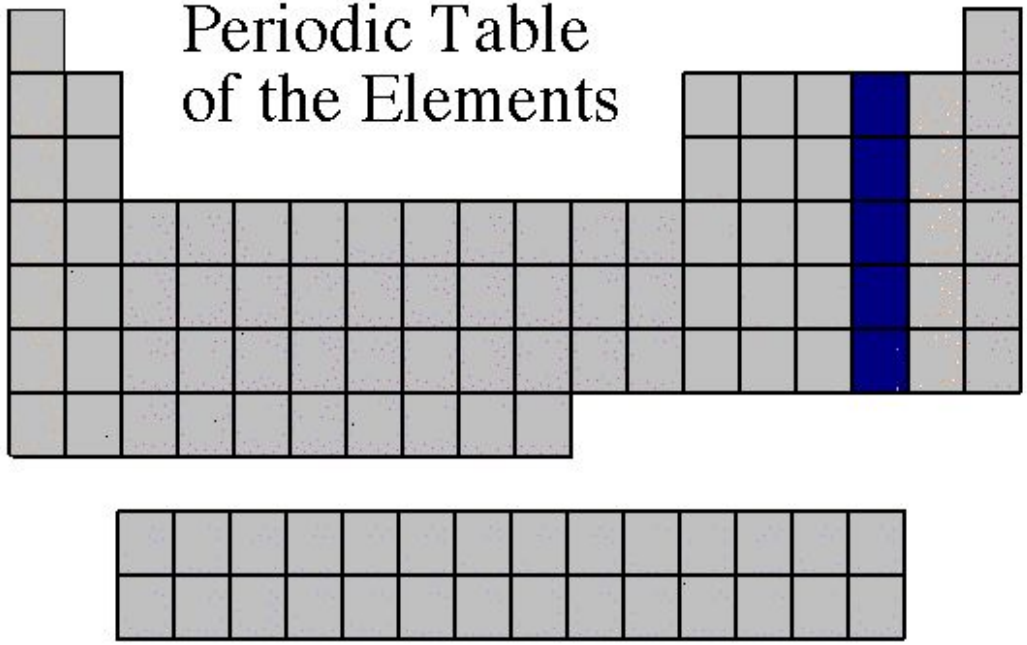
Group 15: the Nitrogen Family

- Form ions with a charge of -3, have 5 valence electrons



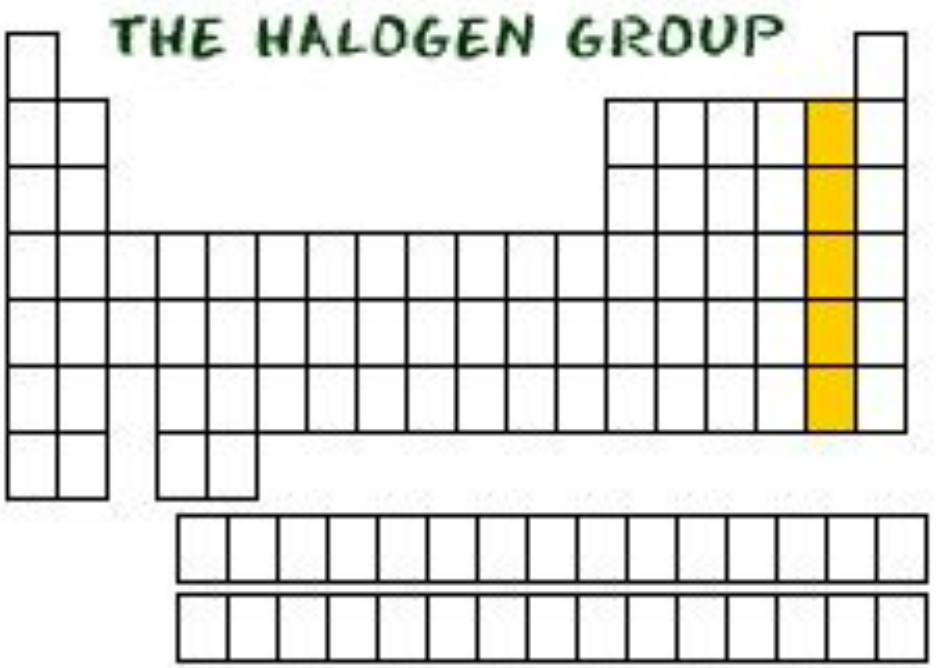
Group 16: The Oxygen Family

- Also known as the chalcogens
- Form ions with a charge of -2, have 6 valence electrons



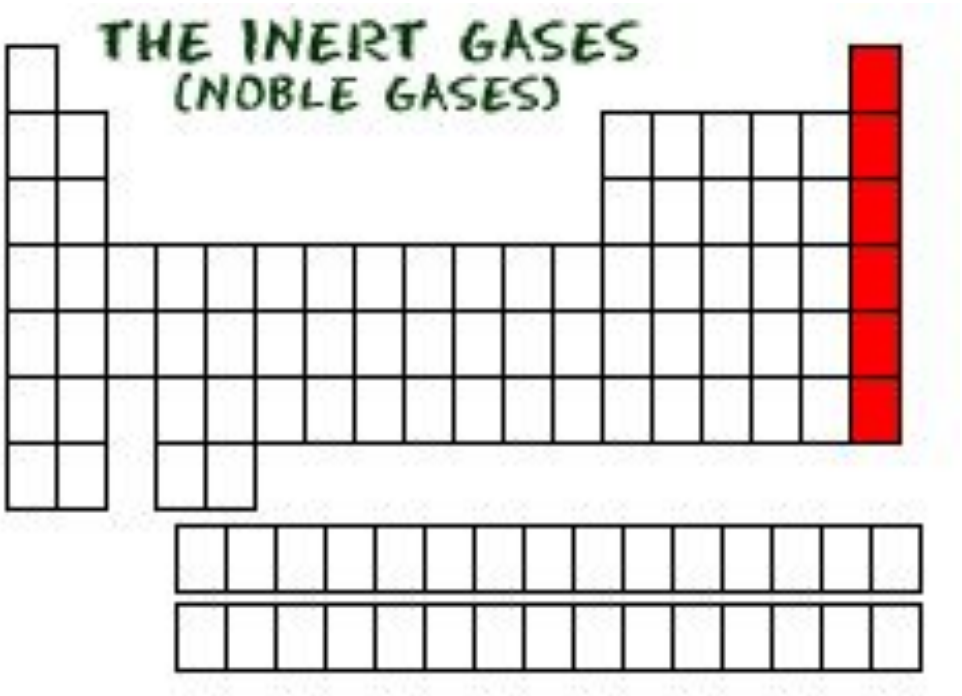
Group 17: the Halogens

- Most <u>reactive nonmetals</u>
- Form ions with a charge of <u>-1</u>, have <u>7</u> valence electrons



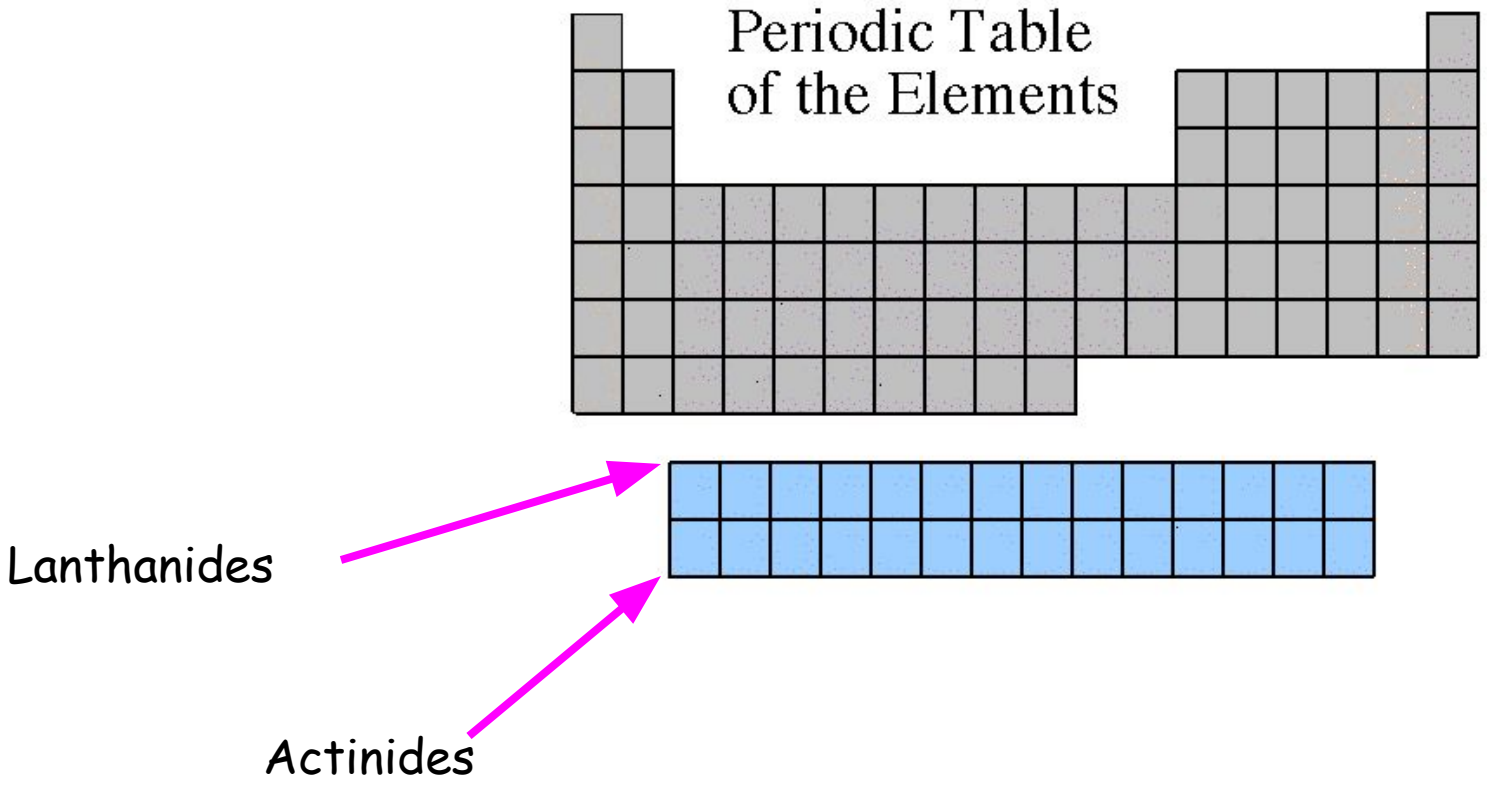
Group 18: The Noble Gases (Inert Gases)

- Nonreactive
- Do not form ions! Charge is 0, have either 2 or 8 valence electrons
- All are gases



Rare Earth Metals

- Some are Radioactive
- The rare earths are silver, silvery-white, or gray metals.
- Conduct electricity



Trends in the Periodic Table

- Atomic size decreases as you move from left to right across the table. Atomic size increases as you move from top to bottom of the table.
- The density of an element increases from top to bottom. The element Osmium has the highest known density.
- The most reactive elements are groups 1 and 17. The least reactive elements are in group 18.