**Classification: Metals**

Properties of Metals:

* They are solid (with the exception of mercury, Hg, a liquid).
* They are shiny, good conductors of electricity and heat.
* They are *ductile* (they can be drawn into thin wires).
* They are *malleable* (they can be easily hammered into very thin sheets).
* Tend to lose electrons easily
* Located to the left of the zig-zag line (except H)

**Classification: Nonmetals**

Properties of Nonmetals:

* Brittle,
* Not malleable,
* Not ductile,
* Poor conductors of both heat and electricity,
* Tend to gain electrons in chemical reactions.
* Some nonmetals are liquids.
* Some are allotropes

**Classification: Metalloids**

* Have properties that are somewhat of a cross between metals and nonmetals.
* Metalloids tend to be economically important because of their unique conductivity properties (they only partially conduct electricity), which make them valuable in the semiconductor and computer chip industry.
* Some are allotropes

**List of metalloids:**

Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te), Astatine (At), Polonium (Po)

**Allotropes**

* **Definition:** different forms of the same elements
* Some elements exist in two or more forms in the same phase
* These forms differ in their molecular crystal structure, hence in their properties
* Elements: B, C, N, O, Al, Si, P, S, Ga, Ge, As, Se, In, Sn, Sb, Te, Tl, Pb, Bi, Po
  + Example: the allotropes of carbon are diamond and graphite

**Alkali Metals – Group 1**

* Very reactive metals that do not occur freely in nature.
* Have only one electron in the outer shell (ready to lose that one electron in bonding with other elements)
* Malleable, ductile, and are good conductors of heat and electricity.
* Softer than most other metals.
* Cesium and Francium are the most reactive elements in this group.
* Alkali metals can explode if they are exposed to water.

**Alkaline Earth Metals – Group 2**

* Very reactive.
* Not found free in nature.
* Two electrons in their outer shell
* High boiling points and melting points
* Low density
* Low electronegativity
* Silver in color
* Ductile
* Malleable
* React easily with the halogens and water
* Softer and stronger than most other metals (except the alkali metals)

**Transition Metals – Groups 3-12**

* Ductile and malleable, and conduct electricity and heat.
* The valence electrons, or the electrons they use to combine with other elements, are present in more than one shell. This is the reason why they often exhibit several common oxidation states.
* There are three noteworthy elements in the transition metals family. These elements are iron, cobalt, and nickel, and they are the only elements known to produce a magnetic field.

**Other Metals**

* Located in groups 13, 14, and 15.
* While these elements are ductile and malleable, they are not the same as the transition elements. These elements, unlike the transition elements, do not exhibit variable oxidation states, and their valence electrons are only present in their outer shell.
* All of these elements are solid, have a relatively high density, and are opaque.
* They have oxidation numbers of +3, ±4, and -3.
* Elements: Aluminum, Gallium, Indium, Tin, Thallium, Lead, Bismuth

**Halogens – Group 17**

* The term "halogen" means "salt-former" and compounds containing halogens are called "salts".
* All halogens have 7 electrons in their outer shells, giving them an oxidation number of -1.
* The halogens exist, at room temperature, in all three states of matter:
  + **Solid**- Iodine, Astatine
  + **Liquid**- Bromine
  + **Gas**- Fluorine, Chlorine

**Noble Gases – Group 18**

All noble gases have the maximum number of electrons possible in their outer shell (2 for Helium, 8 for all others), making them stable.

**Rare Earth Elements**

* Lanthanide and actinide series.
* One element of the lanthanide series and most of the elements in the actinide series are called trans-uranium, which means synthetic or man-made.
* All of the rare earth metals are found in group 3 of the periodic table, and the 6th and 7th periods.