Chapter 17: Elements and Their Properties
Section 3: Mixed Groups

Metalloids: elements that have some properties of metals and some properties of nonmetals

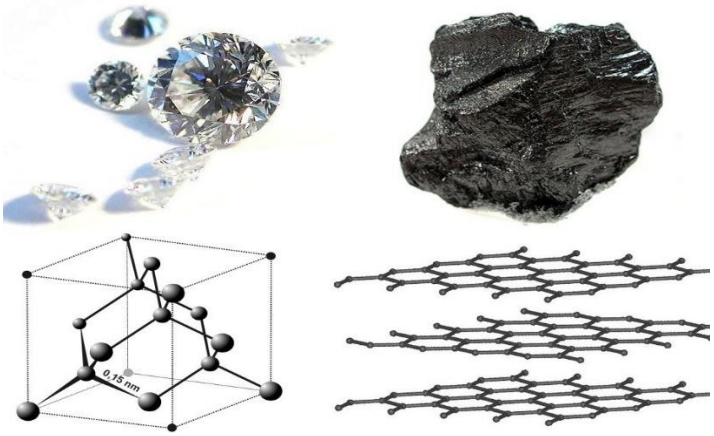
- Can form ionic or covalent bonds (chapter 18)
- Conduct electricity better than nonmetals but not as well as a metal
- Located along the stair-step line on the periodic table
- Groups 13-17 are mixed groups and contain metals, nonmetals, and metalloids

Groups:

- The Boron group: Group 13
  - 3 valence electrons in its outer energy level
  - Boron (metalloid) is used in Borax, a water softener used in laundry products
    - Also used to make heat-resistant glass as in the lab equipment
  - Aluminum (metal) is the most abundant metal in Earth's crust
    - Used for soft-drink cans, foil, pans, and airplanes because it is strong and light
  - Gallium is solid at room temperature but will melt in your hand (melting point = 85.6 ^{o}F)

- The Carbon group: Group 14
  - 4 valence electrons in its outer energy level
  - Carbon (nonmetal) occurs as an element in coal and as a compound in oil, natural gas, and foods

- Carbon compounds are essential to life
- All organic compounds contain carbon
  - Extracts in cooking, lotions/creams, fuel for cars
- Diamond and graphite only contain carbon and are **allotropes** (different molecular structures of the same element)



- Silicon and Germanium (metalloid)
  - Silicon is the second most abundant element in Earth's crust (Oxygen is #1)
  - Found in sand (SiO_2) and in most rocks and soil
  - **Semiconductor:** elements that conduct an electric current under certain conditions
    - Used in many electronics such as computers and phones
    - Silicon and Germanium
- Tin and Lead (metals)
  - Tin is used to coat other metals to prevent corrosion
  - Lead used to be used in paint and is used in car batteries

- The Nitrogen group: Group 15
  - 5 valence electrons in its outer energy level
  - Nitrogen and Phosphorus (nonmetals)
    - Nitrogen is used to make ammonia (NH_3) and nitrates (NO_3^-)
      - Both are used in fertilizers
    - Nitrogen is the 4th most abundant element in your body
    - Phosphorus is found in match heads and fine china
  - Arsenic and Antimony (metalloids) and Bismuth (metal)
    - Sb and Bi are used with other metals to lower melting points
    - Bismuth is used in Pepto Bismol

- The Oxygen group: Group 16
  - Also called the Chalcogens
  - 6 valence electrons in its outer energy level
  - Oxygen (nonmetal)
    - Exists as a diatomic molecule (O_2)
    - During electrical storms, some oxygen molecules change into ozone molecules (O_3)
      - Ozone protects us from the harmful effects of UV rays from the Sun
  - Sulfur (nonmetal) is used in compound form as pigments in paint
  - Selenium (nonmetal) is used in many multivitamins
  - Tellurium and Polonium (metalloids) are rare

Synthetic elements: elements created in lab

- There are only 3 elements before atomic number 92 that are synthetically made
  - 43 – Technetium
  - 61 – Promethium
  - 85 – Astatine
    - Since its discovery, scientists have found trace amounts in nature
- Element 92 (Uranium) is the last naturally occurring element
  - These elements are called **transuranium elements**
  - All are synthetic and radioactive