CHAPTER 19 Content Outline for Teaching

# Elements and Their Properties

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

## Section 3 Mixed Groups

A. Properties of **metalloids**—form ionic and covalent bonds; have some metallic and some nonmetallic properties; partial conduction gives them **semiconductor** characteristics.

B. The Boron Group—named for the first element in Group 13
   1. Boron—used in water softening products, antiseptics, and fuels
   2. Aluminum—abundant in Earth's crust; used in cans, foil wrap, pans, building materials, and aircraft

C. The Carbon Group—four electrons in outer energy level
   1. Carbon—found in coal, oil, natural gas, and foods
   2. Silicon occurs as an **allotrope**—same element with different molecular structures
      a. Silicon found in sand, rocks, and soil
      b. The main component in **semiconductors**, which conduct electricity under certain conditions
   3. Germanium—also used in semiconductors
   4. Tin—used to coat other metals
   5. Lead—toxic, so no longer used in paint
   6. Diamonds, graphite, and buckminsterfullerene are all allotropes of carbon.

D. The Nitrogen Group—five electrons in outer energy level; tend to form covalent bonds
   1. Nitrogen—used to make nitrates and ammonia
   2. Phosphorus—used in water softeners, fertilizers, match heads, fine china
   3. Antimony and bismuth used with other metals to lower their melting points

E. The Oxygen Group or Group 16
   1. Oxygen—makes up 20% of air, is used by living things in respiration, and provides protection from the Sun's radiation
   2. Sulfur—used to form sulfides for pigment in paint
   3. Selenium—used in photocopiers and multivitamins
   4. Tellurium and polonium are also oxygen group elements.

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## Elements and Their Properties (continued)

F. Synthetic Elements—scientists create elements not usually found on Earth; synthetic elements usually disintegrate quickly.

1. Uranium can be made into neptunium which forms plutonium when it disintegrates.
2. Plutonium can be changed into americium, which is used in smoke detectors.
3. **Transuranium elements** have more than 92 protons and are synthetic and unstable
   - **a.** The study of synthesized elements helps scientists to understand the forces holding the nucleus together.
   - **b.** Element 114 lasted for 30 seconds.
   - **c.** It combined 114 protons with 175 neutrons.
   - **d.** It broke apart due to enormous repulsion between the protons.

**Discussion Question**

**Why do scientists create new elements?** To understand atomic forces and attempt to find a useful application for them

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