Mixed Elements and Their Properties

1. Groups 13–16 contain elements that are metals, metalloids and nonmetals.

2. Boron Group (13): All have 3 electrons in their outer shell.
   a. Boron is used in boric acid, the only acid safe for eyes, used as an antiseptic; found in borax used in laundry products.
   b. Aluminum, most abundant metal, used in cans, house siding,foil,cars and airplanes because it is light in weight, resists corrosion, and relatively inexpensive.
   c. Gallium, Indium and Thallium are used in the semiconductor business.

3. Carbon Group (14):All have 4 electrons in their outer shell.
   a. Carbon is the basic element for life and organic compounds. Exists in several forms(allotropes) with different molecular structures. Slippery graphite, found in pencils and special lubricants, and ultra hard diamond are carbon allotropes. Graphite's molecules are in layers that easily move past each other. Diamond forms a tetrahedron shape, that interlocks with other tetrahedrons making for a very hard substance.
   b. Silicon, very abundant in earth's crust in rock, sand and quartz. Along with Germanium, it is used to make semiconductors.
   c. Tin is a non-rusting metal used to line steel cans and in making bronze and pewter.
   d. Lead, though toxic was used for centuries in plumbing, paints and recently in gasoline. Used in fishing sinkers and is the 'shot' in shot gun shells.

4. Nitrogen Group (15): All have 5 electrons in their outer shell. These share electrons (covalent bonds) with other elements.
   a. Nitrogen is 80% of air, and is essential for life and all proteins. Used for fertilizers, and all explosives.
   b. Phosphorus has 3 allotropes, and is found in fertilizers, water softeners and in the reddish head of matches.
   c. Antimony is used in solder, and it and Bismuth, along with other metals make low melting point metals like in fire-sprinkler heads.
   d. Bismuth is found in Pepto-bismol and is now part of a treatment for ulcers.

5. Oxygen Group (16): All have 6 electrons in their outer shell.
   a. Oxygen makes up about 20% of air and is essential for life, especially all animal life. Needed for fire, and one allotrope of oxygen, Ozone (O3) protects us from hazardous UV radiation. Ozone is a respiratory irritant and causes many problems for asthmatics.
   b. Sulfur is essential for life (proteins) and is used in various pigments.
   c. Selenium, an important trace element in our diet, is also used in photocopying machines.
   d. Tellurium, though not yet very important, will give you garlicky breath if inhaled.
   e. Polonium, the scarcest natural element was discovered by and named after Marie Curie's homeland, Poland.