# Chapter 4: Organization of the Periodic Table: *The Families of Elements Resource Information*

## *Group 1: The Alkali Metal Family*

The alkali metal family is found on the periodic table in Group 1, which is on the far left side of the table. The metals in this group are lithium, sodium, potassium, rubidium, cesium, and francium. The gas hydrogen is also put in this group because of its reactivity.

All of the metals in this group are soft, silvery-white metals with low melting points. These metals, along with hydrogen, are extremely reactive. Hydrogen will blow up upon any contact with flames. The metals are so reactive that they will burn the skin if touched. They tarnish rapidly. The metals in this family react violently with water. They easily form salts with the halogens. They are never found in their pure forms in nature. The metals in this family are easy to identify because they each give off a different color when they burn. Lithium flames are a crimson color, sodium flames are yellow, potassium flames are violet, rubidium flames are reddish-violet, and cesium flames are blue. Little is known about francium because it is so rare and radioactive.

The alkali metal family has many important uses. Lithium is used in grease and other lubricants. It is also used in aircraft parts and batteries. Sodium is found in salt, and used in gasoline. Potassium is more expensive than sodium and is less widely used. Potassium is used in fertilizer and photography. For more uses of the alkali metals, see the *Uses of the Elements* booklet.

## *Group 2: The Alkaline Earth Metal Family*

The alkaline earth metal family is found on the periodic table in Group 2, which is on the far left side of the table between Group 1, the alkali metals, and Groups 3-12, the transition elements. This family is made up of six metals (beryllium, magnesium, calcium, strontium, barium, and radium).

The metals in this family are all soft and silvery-white in color. They have high melting points and high densities. They are reactive. They will react with water. They can be handled by humans. These metals will oxidize or tarnish in air. They are never found in nature in their pure forms. They are good conductors of electricity. Each element of this family burns in a different color. Magnesium will give off a bright white light. Calcium flames are an orange-red. Strontium flames give off a bright red color. Barium will burn with a yellowish-green color. Radium gives off a vivid crimson color when it burns.

The alkaline earth metals are used in fireworks because of their bright colors when they burn. Beryllium is often added to other metals to make hard metal alloys. Beryllium is also used to make rocket nose cones. Beryllium is used in nuclear reactors. Magnesium is used in aircraft and photographic equipment. Calcium is used with other metals to make reactive alloys. Radium is radioactive and is used in the treatment of cancer. For other uses of the alkaline earth metals, see the *Uses of the Elements* booklet.

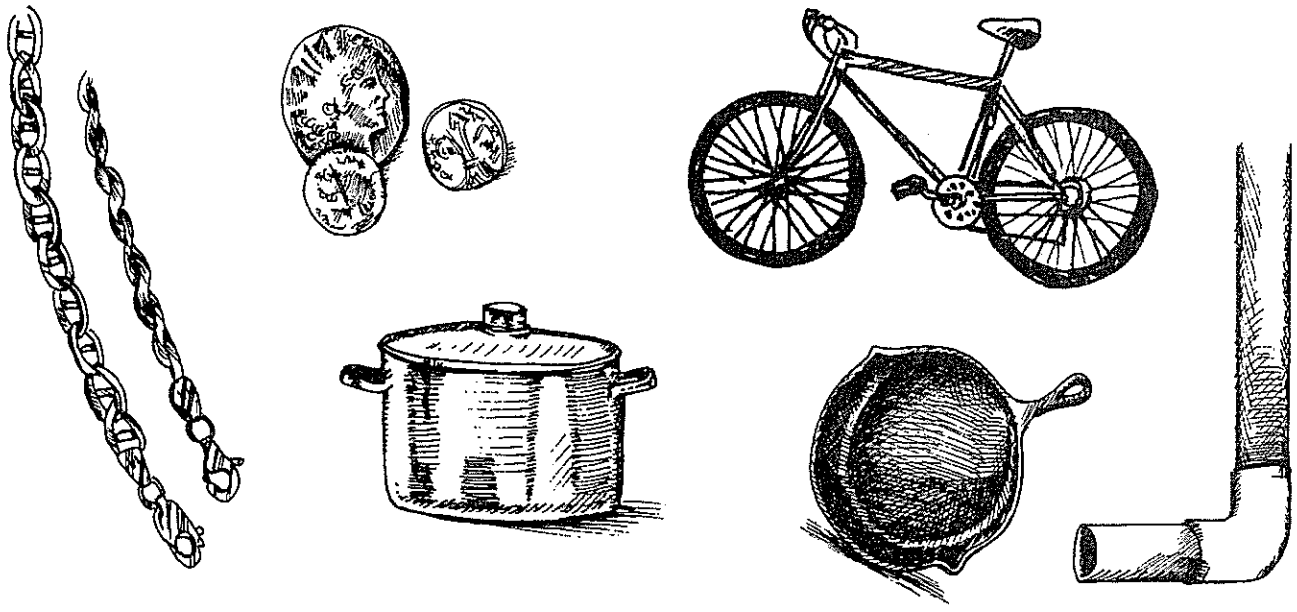
# Chapter 4: Organization of the Periodic Table: *The Families of Elements Resource Information*

## *Groups 3-12: The Transition Element Family*

The transition element family is found in the middle of the periodic table in Groups 3-12. The transition element family is by far the largest family on the periodic table with 40 members. Some of the more common and widely-used members of this family include iron, nickel, copper, zinc, silver, and gold.

The transition elements are all metals; that's why they are sometimes called the transition metals. Most of the elements in this family are hard, strong, and shiny metals. Most of them have very high melting points and boiling points. Mercury is one exception; it is a liquid at room temperature. Most transition elements are good conductors of heat and electricity. Most transition elements will dissolve in acid. Gold is one exception; it resists acids. Most transition elements can bond to oxygen in more ways than one, making different compounds. Iron is a good example of this behavior. Iron bonds with oxygen to form the ores hematite and magnetite. Both ores have different ratios of oxygen and iron. Most of these elements can be pounded into shapes and drawn into wires. Most of the transition elements can form colored compounds with oxygen. Zinc, titanium, and chromium form many colored compounds with oxygen.

The transition elements have many uses because of their ability to form strong metal alloys, their ability to be pounded into shapes, their ability to be drawn into wires, and their beauty. It is because of these abilities that transition elements are used in construction materials, pipes, wires, coins, jewelry, aircraft, cars, bicycles, cooking utensils, and many other items. Many transition elements are used to manufacture widely-used compounds, such as cleaners. Many transitions elements are used in catalytic converters, which help control the pollution in car exhaust. Transition elements are also added to paints to give them color. For other uses of transition elements, see the *Uses of the Elements* booklet.



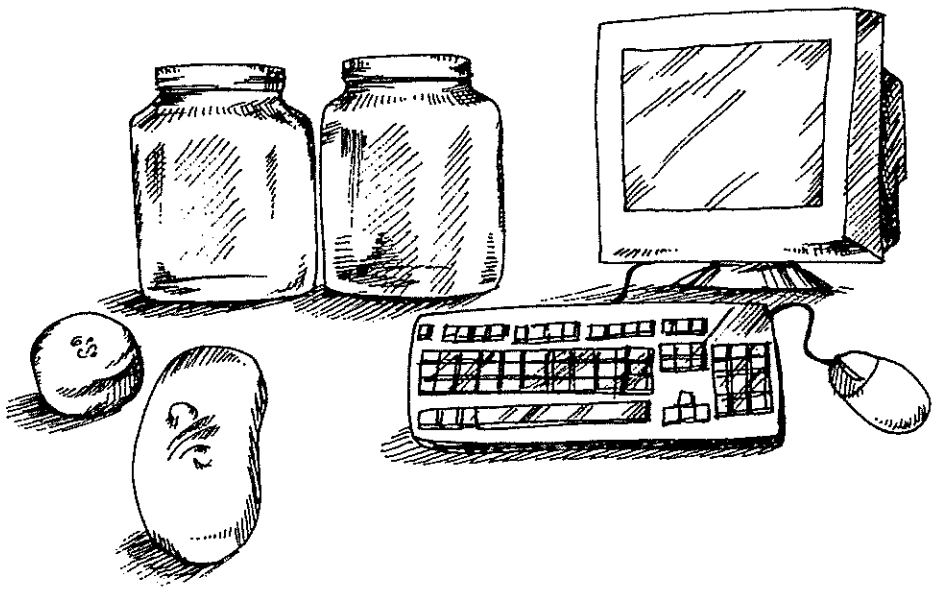
# Chapter 4: Organization of the Periodic Table: *The Families of Elements Resource Information*

## *Groups 13-16: The BCNO Family*

The BCNO family is found on the right side of the periodic table between the transition elements (Group 3-12) and the halogens (Group 17). The BCNO family is a very large family with 25 members. Some of the more common members of this family include carbon, nitrogen, oxygen, aluminum, silicon, sulfur, arsenic, tin, and lead.

The BCNO family is sometimes divided into two or even four separate families. This is by far the most diverse family of elements. The BCNO family is given its name because of the symbols of the lightest elements in each column of the family: boron (B), carbon (C), nitrogen (N), and oxygen (O). The members of this family are metals, nonmetals, or metalloids. Some members of this family are gases at room temperature (nitrogen and oxygen), but most are solids. They are reactive but are selective with which elements they will bond. Most will bond with oxygen. Oxygen will even bond with itself. There are no hard and fast rules that fit all the elements of this family except that the members of each column tend to bond with other elements in a similar fashion.

There is a wide variety of uses for the BCNO family. This is because there is a wide variety of elements. Many of the elements of the BCNO family are essential to life (carbon, oxygen, nitrogen, and phosphorus). The metals in this family are used in the electronics industry. Silicon and germanium are used in computers. The nonmetals in this family are used as insulators on wires because they will not conduct electricity. Some members in this family are used as poisons, fertilizers, in scuba gear, soap, glass-making, solder, aircraft, and weapons. Aluminum is a member of this family with many uses, including drink cans, foil, pots, and pans. For more uses of the BCNO family, see the *Uses of the Elements* booklet.



# Chapter 4: Organization of the Periodic Table: *The Families of Elements Resource Information*

## *Group 17: The Halogen Family*

The elements of Group 17, the halogens, are found on the right side of the periodic table between Groups 13-16 (the BCNO family) and Group 18 (the noble gases). The halogens are a very small family consisting of only five elements (fluorine, chlorine, bromine, iodine, and astatine).

The halogens are a family of poisonous nonmetals. At room temperature fluorine and chlorine are gases, bromine is a liquid, and iodine and astatine are solids. The halogens are very reactive and are never found in their pure forms in nature. The reactivity of the halogens decreases as atomic number increases. The halogens are poor conductors of electricity. The halogens will combine with the alkali metals to form a family of chemical compounds called salts.

The halogen family has a variety of uses. Fluorine is added to toothpaste and water to prevent tooth decay. Fluorine will combine with uranium to form nuclear fuel. Chlorine is added to water supplies and swimming pools to kill germs. Chlorine is widely used in bleach and salt. Bromine is used as a gasoline additive, photograph developer, fire retardant, and an insecticide. Bromine is also used to kill germs in water supplies. Iodine is added to salt to reduce thyroid disease. Iodine is also used as a film developer and as a disinfectant in water supplies. Astatine is very rare, very radioactive, and has no uses. For more uses of the halogen family, see the *Uses of the Elements* booklet.

## *Group 18: The Noble Gases*

The noble gases are found in the far right column of the periodic table just to the right of Group 17, the halogens. The noble gases are a family of six gases: helium, neon, argon, krypton, xenon, and radon.

All of the members of the noble gas family are colorless, tasteless, and odorless gases. They are extremely nonreactive. Helium, neon, and argon will not combine with other elements. Xenon, krypton, and radon will combine with other elements, but this is a very difficult process to perform. When an electrical current is passed through one of these gases, it will glow in a characteristic color. Neon has a characteristic orange-red glow.

Helium is lighter than air and is used in balloons and blimps. Neon, argon, krypton, and xenon are used in lights because of the colors they make and in light bulbs because they do not react with the metal (usually tungsten) that makes up the filament. Radon is radioactive and is used in the treatment of cancer. For more uses of the noble gas family, see the *Uses of the Elements* booklet.

# Chapter 4: Organization of the Periodic Table: *The Families of Elements Resource Information*

## *The Lanthanide Series*

The lanthanide series of elements is found at the bottom of the periodic table. This series appears in the top of the bottom two rows. It consists of 15 elements, including lanthanum.

Every member of the lanthanide series is a soft, silvery metal. These metals are reactive and will burn in oxygen or air. They will oxidize or tarnish rapidly in air. The lanthanide series metals are similar to the metals in the transition elements family, except they are poor conductors of electricity. The lanthanides all react in a similar manner, and it is because of this that they are found together in nature. Lanthanides produce a spark when struck.

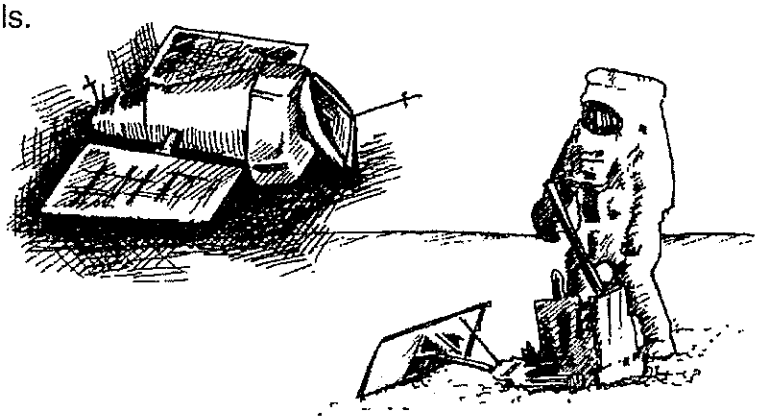
Lanthanide alloys made with iron are used to make flints for cigarette lighters because of their ability to produce a spark. Several of the metals in this series are used in glass, welders' goggles, nuclear reactors, and the petroleum industry. Many of the lanthanides are used in color television screens and computer monitors because they produce colors when combined with phosphorus. Some examples of the colors produced by lanthanides include red from europium and green from terbium. For more uses of the lanthanide series, see the *Uses of the Elements* booklet.

## *The Actinide Series*

The actinide series of elements is found in the very bottom row of the periodic table. This series is made of 15 elements, including actinium and uranium.

The members of the actinide series are all radioactive. All of the actinides are silvery metals. All of the elements in the actinide series are reactive. Actinium, thorium, protactinium, and uranium are all natural. Neptunium and plutonium were once thought to be only synthetic, but small amounts have been found in nature. All other members of this series are synthetic. All of the actinides after curium are very radioactive and have been produced in such small amounts that little is known about these elements.

Uranium is by far the most stable actinide. It is used as a fuel for nuclear power plants and nuclear weapons. Uranium is also used as a pigment in glass and ceramics. Plutonium is used in nuclear weapons and to power space exploration equipment. Curium is used to power satellites and was used to test moon soils. Americium is used in smoke detectors. For more uses of the actinides, see the *Uses of the Elements* booklet.



Name: _____ Date: _____

# Chapter 4: Organization of the Periodic Table: *The Families of Elements—Group Quiz*

**Directions:** Use the family posters created by your class, along with a periodic table, to answer the questions below with your group.

**Part I. Examples:** In the space provided, write the name of the family to which each element belongs.

1. Silver _____
2. Helium _____
3. Cerium _____
4. Sodium _____
5. Chlorine _____
6. Uranium _____
7. Nitrogen _____
8. Calcium _____
9. Plutonium _____
10. Lead _____
11. Gold _____
12. Sulfur _____
13. Argon _____
14. Iodine _____
15. Potassium _____
16. Magnesium _____

**Part II. Element Uses**: Give one use for each of the following elements.

17. Aluminum _____
18. Sodium _____
19. Fluorine _____
20. Iodine _____
21. Helium _____
22. Terbium _____
23. Uranium _____
24. Beryllium _____
25. Calcium _____
26. Argon _____

**Part III. Family Uses:** Sometimes entire families of elements can be used for the same purpose. Give one use for each of the following families.

27. Alkaline Earth Metals _____
28. Transition Elements _____
29. Lanthanide Series _____
30. Noble Gases _____

Name: _____ Date: _____

# Chapter 4: Organization of the Periodic Table: *The Families of Elements—Group Quiz (cont.)*

**Part IV. Characteristics:** Give one characteristic of each of the following families.

31. Alkali Metals _____
32. Alkaline Earth Metals _____
33. Transition Elements _____
34. BCNO Groups _____
35. Halogens _____
36. Noble Gases _____
37. Lanthanide Series _____
38. Actinide Series _____

**Part V. Drawings:** Make a drawing that shows a characteristic, example, or use for each of the following families.

**Alkali Metals**

**Alkaline Earth Metals**

**Transition Elements**

**BCNO Group**

**Halogens**

**Noble Gases**

**Lanthanides**

**Actinides**