

Name:

Date:

Period:

# WE ARE FAMILY!



Directions: Today, we are going to learn about families on the periodic table. Please follow each step!

## Part 1: The Simpsons Family

What do all the Simpsons Family characters have in common with each other? List 5 similarities.

## Part 2: Thinking back to the Bubble Family.

I want you to think back to the Bubble Family Activity and answer these questions:

1.) How did you organize the Bubble Family Members?



2.) What did you notice about the family members when you went from the top of the Bubble Family to the bottom?

3.) How do you think the groups (remember they go UP AND DOWN) of the Periodic Table are similar to the groups (UP AND DOWN) of the Bubble Family?

### **Part 3: Periodic Table Regions**

The periodic table is divided into three different regions based on their physical and chemical properties. Go to this website: <http://www.windows.ucar.edu/tour/link=/earth/geology/metals.html&edu=high> to investigate.

What are those 3 regions?

- 1.
- 2.
- 3.

Next, take 3 different colored pencils and color the three regions on your FIRST periodic table on the back of this webquest.

What are the characteristics of metals?

- 1.
- 2.
- 3.
- 4.
- 5.

What are the characteristics of non-metals?

- 1.
- 2.
- 3.
- 4.
- 5.

What are metalloids?

### **Part 4: Looking at the Periodic Table Families**

We are now going to examine some of the families that we can find on the Periodic Table and see what they have in common with each other.

Go to the website: [http://www.chem4kids.com/files/elem\\_families.html](http://www.chem4kids.com/files/elem_families.html)

- 1.) What are some examples of family names on the Periodic Table?
  - a.
  - b.

- c.
- d.
- e.

2.) How are the elements grouped into families?

3.) How do periodic table families differ from each other?

### Part 5: Alkali Metals

Click on **Alkali Metals** on the right side of the website (or go to [http://www.chem4kids.com/files/elem\\_alkalimetal.html](http://www.chem4kids.com/files/elem_alkalimetal.html))

The first family we are going to look at today is the Alkali Metal Family.

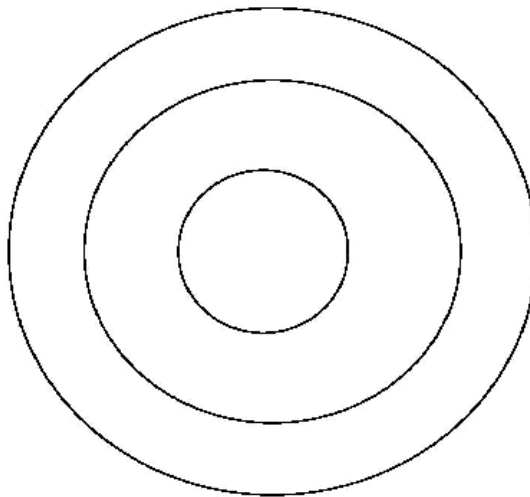
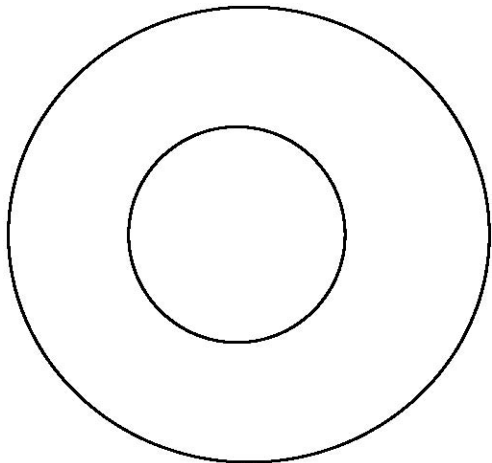
1.) **Color** and **label** this family on your SECOND periodic table on the back of this webquest. Use the **green colored pencil**.

2.) Look at the section "Family Portrait." Is Hydrogen included in this family? Why or why not?

3.) Look at the first paragraph under "Family Bonding." Are these elements **reactive or not**? Why?

4.) Look at the last paragraph under "Family Bonding." What do all alkali metals have in common?

5.) Take a look at **lithium** and **sodium**. Draw the **electrons** for each of these atoms:



What do you notice that **lithium and sodium** have in common?

### Part 6: Alkali Earth Metals.

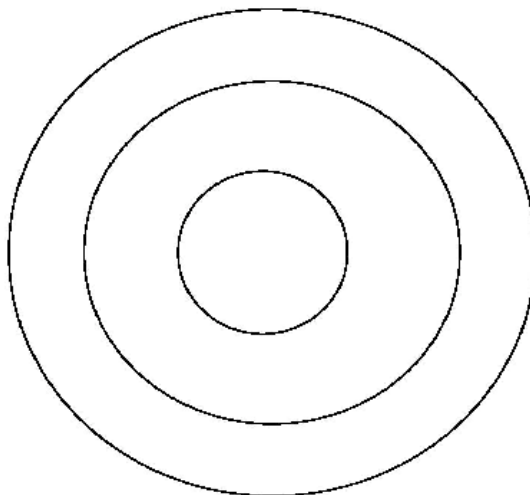
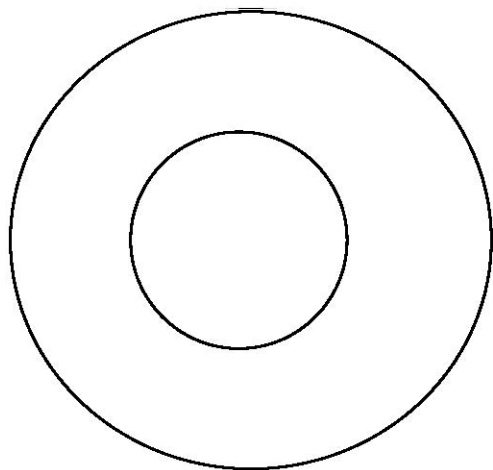
Click on **Alkali Earth Metals** on the right side of the website (or go to [http://www.chem4kids.com/files/elem\\_alkalineearth.html](http://www.chem4kids.com/files/elem_alkalineearth.html))

1.) **Color** and **label** this family on your periodic table. Use the **purple colored pencil**.

2.) Are alkali earth metals **reactive** or not? Why or why not? (Look at the first paragraph of “Family Portrait.”)

3.) In every day life, where are alkali earth metals found? (look at the last paragraph).

4.) Draw the **electrons** for **Be** and **Mg**.



What do **Be** and **Mg** have in common about their electrons?

#### Part 7: Transition Metals

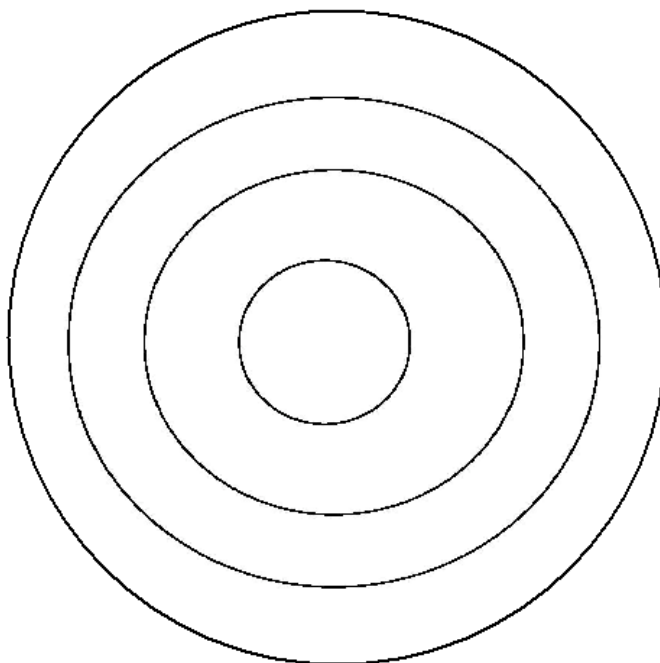
Click on **Transition Metals** on the right side of the website or go to

[http://www.chem4kids.com/files/element\\_transmetal.html](http://www.chem4kids.com/files/element_transmetal.html)

1.) **Color** and **label** this family on your periodic table. Use the **yellow colored pencil**.

2.) What's so special about Transition Metals? (Look at the 2<sup>nd</sup> paragraph under “What's so Special?”)

3.) Prove that transition metals are special by drawing the electrons for **Scandium** (21). Is the website correct?



Now go to page 12 & 13 of this packet to answer the following questions.

4.) The transition metals make up groups \_\_\_ to \_\_\_\_\_.

5.) List examples of some common transition metals below:

6.) Why are ancient transition metals such as gold so beautiful and detailed even today?

7.) Why is iron so important to our health?

### **Part 8: Lanthanides**

Click on **Lanthanide** on the right side of the website or go to [http://www.chem4kids.com/files/elem\\_lanthanide.html](http://www.chem4kids.com/files/elem_lanthanide.html).

**Color** and **label** this family on your periodic table. Use the **orange colored pencil**.

1.) Some call the Lanthanides \_\_\_\_\_ elements and others call them the \_\_\_\_\_.

Now go to page 14 & 15 of this packet to answer the following questions:

2.) What kind of physical properties do Lanthanides have?

3.) Lanthanides made alloys – what are alloys?

### **Part 9: Actinides**

Click on **Actinides** on the right side of the website or go to [http://www.chem4kids.com/files/elem\\_actinide.html](http://www.chem4kids.com/files/elem_actinide.html).

**Color** and **label** this family on your periodic table. Use the **brown colored pencil**.

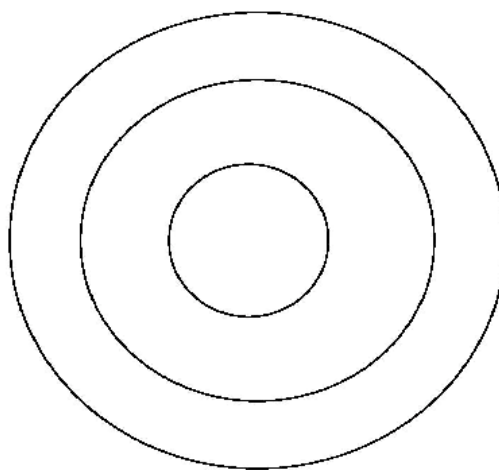
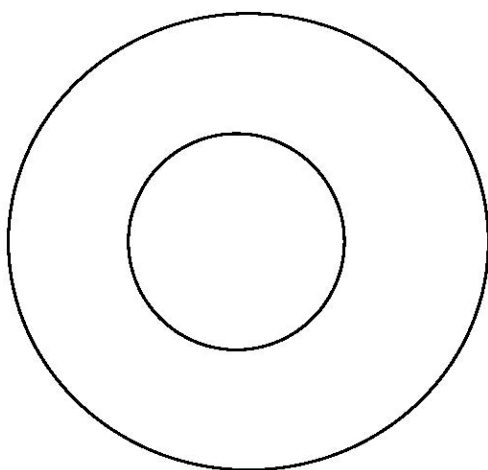
1.) All actinide elements are \_\_\_\_\_.

2.) Not all the actinide elements are found in nature; some have been made \_\_\_\_\_.

## Part 10: The Carbon Family

Go to page 16 of the packet to answer the following questions:

- 1.) **Label** this family on your periodic table. Keep this column **white**.
- 2.) Each element in the carbon family has atoms that can \_\_\_\_\_, \_\_\_\_\_ or \_\_\_\_\_ electrons.
- 3.) What group is this family on the periodic table? Group \_\_\_\_\_
- 4.) Which element is the only **non-metal** in the group? \_\_\_\_\_
- 5.) Write down 2 examples that are made mostly of carbon: \_\_\_\_\_ and \_\_\_\_\_.
- 6.) Take a look at Carbon and Silicon. Draw the electrons for **C** and **Si**.



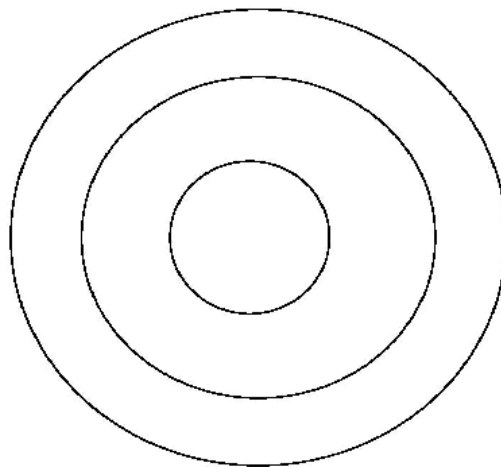
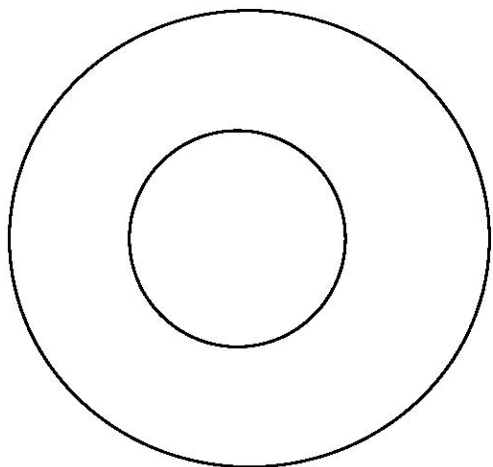
What do Carbon and Silicon have in common with their electrons?

## Part 11: Nitrogen Family

Go to page 17 of the packet to answer the following questions:

- 1.) **Color** and **label** this family on your periodic table. Use another shade of **green**.
- 2.) What group is the Nitrogen family? \_\_\_\_\_
- 3.) Nitrogen is a very common element – where you can find it normally?
  
- 4.) What is nitrogen fixation?

5.) Take a look at nitrogen and phosphorus. Draw the electrons for **N** and **P**.



What do nitrogen and phosphorus have in common with their electrons?

### Part 12: Oxygen Family

Go to page 18 of the packet to answer the following questions:

1.) **Color** and **label** this family on your periodic table. Use the **black pencil**.

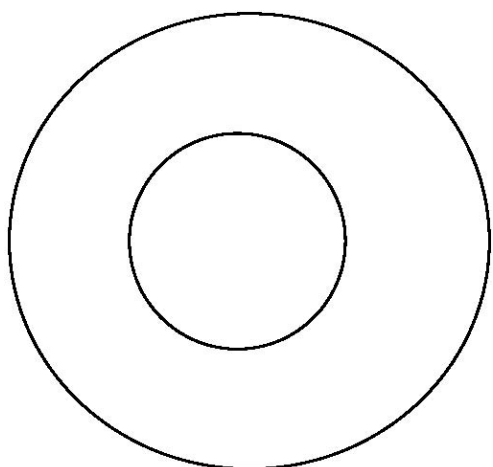
2.) What group is the Oxygen family? \_\_\_\_\_

3.) Name the 3 nonmetals in the oxygen family: \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.

4.) What is oxygen used for?

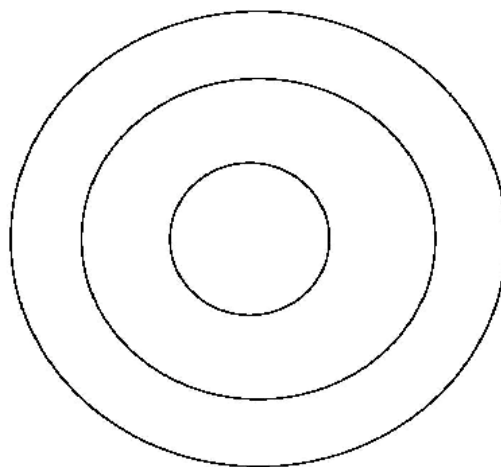
5.) What is the difference between a diatomic and a triatomic molecule? Give an example of a diatomic and a triatomic molecule.

6.) Why does oxygen combine with almost every other element?



7.) What  
used  
does  
like?

8.) Take



is sulfur  
for? What  
it smell

a look at

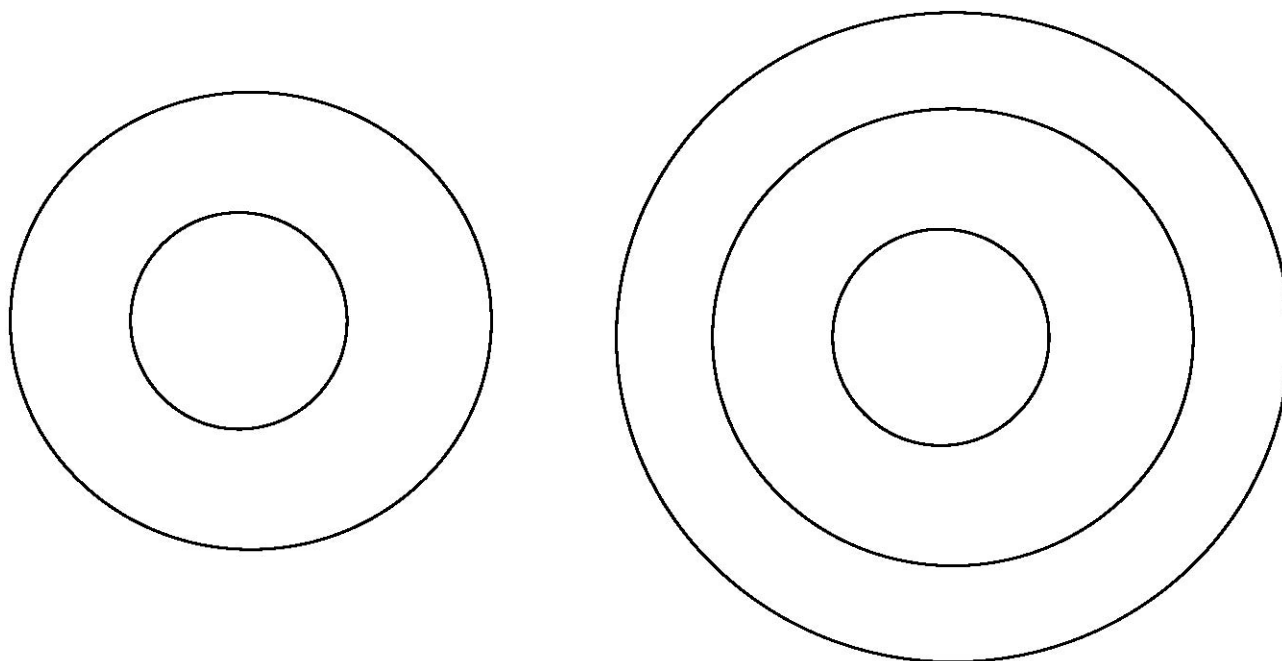
What do oxygen and sulfur have in common with their electrons?



### Part 13: Halogen Family

Click on **Halogen Family** on the right side of the website or go to [http://www.chem4kids.com/files/elem\\_halogen.html](http://www.chem4kids.com/files/elem_halogen.html).

- 1.) **Color** and **label** this family on your periodic table. Use the **red colored pencil**.
- 2.) What do we know about their electrons? (Look at the first paragraph in the section called "What makes them similar?")
- 3.) Are these elements **reactive**? Why or why not?
- 4.) Prove this is correct by drawing the **electrons** for **F and Cl**.



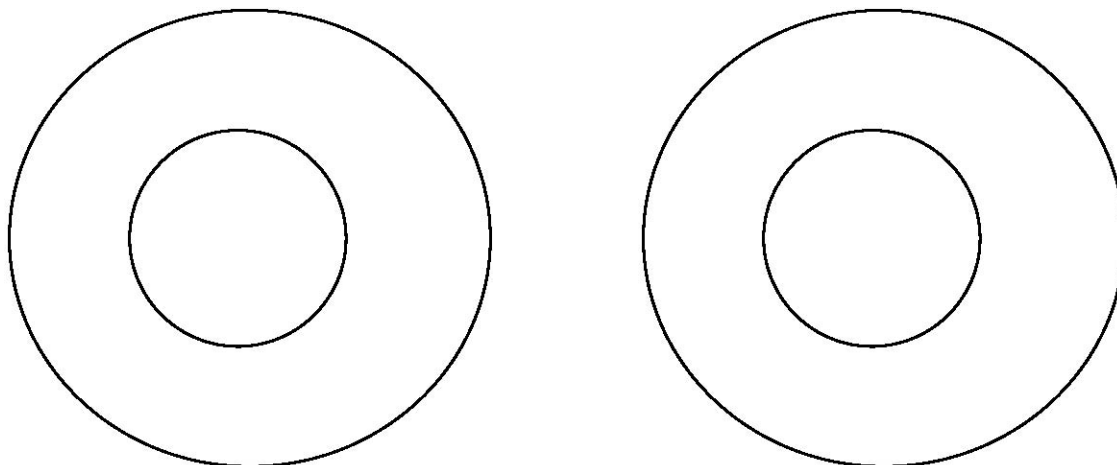
What do F and Cl have in common with their electrons?

Go to page 19 of the packet to answer the next questions.

- 5.) What does "halogen" mean? \_\_\_\_\_
- 6.) Is fluorine dangerous? What about chlorine? Why?
- 7.) Halogens form a lot of different compounds. List two examples of halogen compounds and what they are used for.

### Part 14: Inert or Noble Gases

1. **Color** and **label** this family on your periodic table. Use the **blue colored pencil**.
2. Why are these elements happy? (Look under the section “Why are they happy?”)
- 3.) Are these elements **reactive**? Why or why not?
- 4.) See if this is correct by drawing the electrons for **He** and **Ne**.



What do **He** and **Ne** have in common with their electrons?

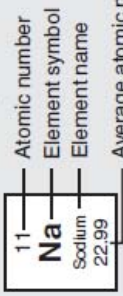
### Part 15: Hydrogen

Look on page 20 of your packet under the section called “Hydrogen.”

- 1.) Why can't hydrogen be grouped with any family?
- 2.) Hydrogen makes up \_\_\_\_\_ % of all the atoms in this world but makes up only \_\_\_\_% of the Earth's crust.
- 3.) Is hydrogen usually found as a pure element? If not, what form is it usually found in?
- 5.) Write down 2 uses for these types of gases. (Look under “Who's in the Family?”)

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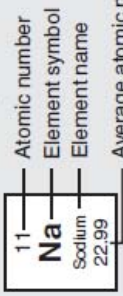
**Key**



\* If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.

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**Key**



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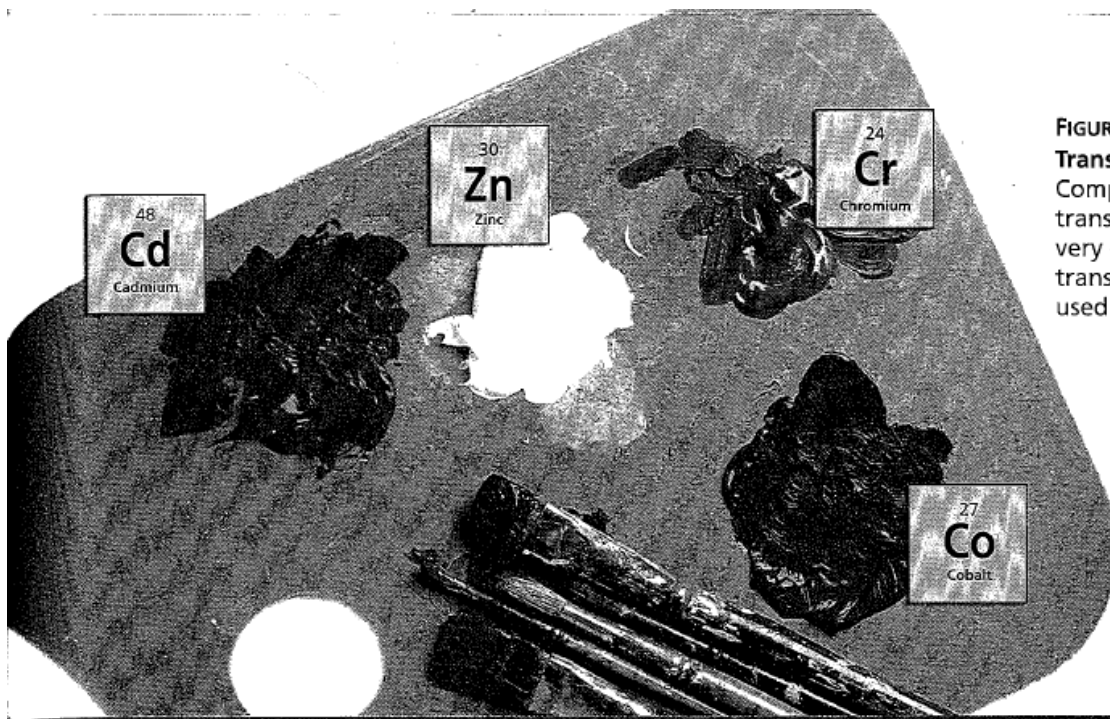
**Transition Metals** The elements in Groups 3 through 12 are called the **transition metals**. The transition metals include most of the familiar metals, such as iron, copper, nickel, silver, and gold. Most of the transition metals are hard and shiny. All of the transition metals are good conductors of electricity. Many of these metals form colorful compounds.

The transition metals are less reactive than the metals in Groups 1 and 2. This lack of reactivity is the reason ancient gold coins and jewelry are as beautiful and detailed today as they were thousands of years ago. Even when iron reacts with air and water, forming rust, it sometimes takes many years to react completely. Some transition metals are important to your health. For example, you would not survive without iron. It forms the core of a large molecule called hemoglobin, which carries oxygen in your bloodstream.

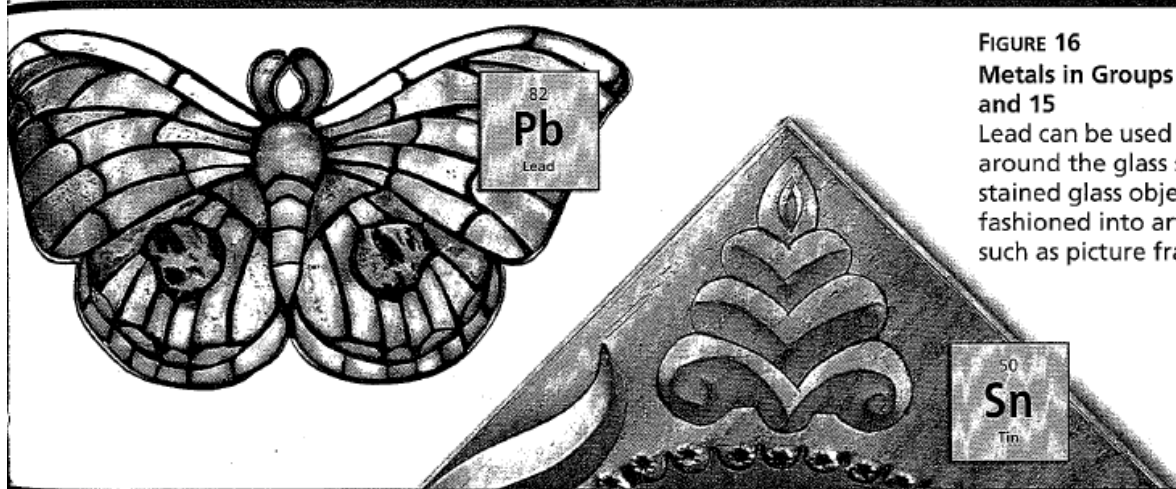
**Metals in Mixed Groups** Only some of the elements in Groups 13 through 15 of the periodic table are metals. These metals are not nearly as reactive as those on the left side of the table. The most familiar of these metals are aluminum, tin, and lead. Aluminum is the lightweight metal used in beverage cans and airplane bodies. A thin coating of tin protects steel from corrosion in some cans of food. Lead was once used in paints and water pipes. But lead is poisonous, so it is no longer used for these purposes. Now, its most common uses are in automobile batteries and weights for balancing tires.

**Lanthanides** Two rows of elements are placed below the main part of the periodic table. This makes the table more compact. The elements in the top row are called the lanthanides (LAN tuh nydz). Lanthanides are soft, malleable, shiny metals with high conductivity. They are mixed with more common metals to make alloys. An **alloy** is a mixture of a metal with at least one other element, usually another metal. Different lanthanides are usually found together in nature. They are difficult to separate from one another because they all share very similar properties.





**FIGURE 15**  
**Transition Metals**  
 Compounds made with transition metals can be very colorful. Several transition metals are used to make paints.



**FIGURE 16**  
**Metals in Groups 13, 14, and 15**  
 Lead can be used in the borders around the glass sections in stained glass objects. Tin can be fashioned into artistic objects, such as picture frames.

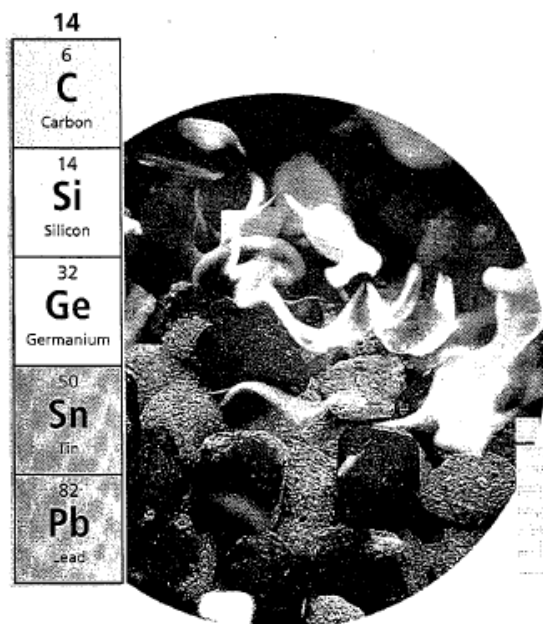


**FIGURE 17**  
**Lanthanides**  
 Neodymium is used in manufacturing the tiny speakers inside stereo headphones.

FIGURE 21

### Reactions of Nonmetals

The table salt on a pretzel is mined from deposits found on Earth. The same compound can also be formed from a reaction between the metal sodium and the nonmetal chlorine.



## Families of Nonmetals

Look again at the periodic table. Notice that only Group 18 contains elements that are all nonmetals. In Groups 14 through 17, there is a mix of nonmetals and other kinds of elements.

**The Carbon Family** Each element in the carbon family has atoms that can gain, lose, or share four electrons when reacting with other elements. In Group 14, only carbon is a nonmetal. What makes carbon especially important is its role in the chemistry of life. Compounds made of molecules containing long chains of carbon atoms are found in all living things.

Most of the fuels that are burned to yield energy contain carbon. Coal, for example, is mostly the element carbon. Gasoline is made from crude oil, a mixture of carbon compounds with chains of 5 to 50 or more carbon atoms in their molecules.

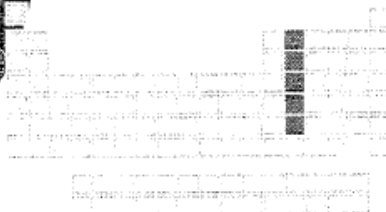


FIGURE 22

### Carbon

Charcoal is one form of carbon, the only nonmetal in Group 14.

**The Nitrogen Family** Group 15, the nitrogen family, contains two nonmetals, nitrogen and phosphorus. These nonmetals usually gain or share three electrons when reacting with other elements. To introduce yourself to nitrogen, take a deep breath. The atmosphere is almost 80 percent nitrogen gas ( $N_2$ ). Nitrogen does not readily react with other elements, so you breathe out as much nitrogen as you breathe in.

Nitrogen is an example of an element that occurs in nature in the form of diatomic molecules, as  $N_2$ . A **diatomic molecule** consists of two atoms. In this form, nitrogen is not very reactive. Although living things need nitrogen, most of them are unable to use nitrogen from the air. However, certain kinds of bacteria can use this nitrogen to form compounds. This process is called nitrogen fixation. Plants can then take up these nitrogen compounds formed in the soil by the bacteria. Farmers also add nitrogen compounds to the soil in the form of fertilizers. Like all animals, you get the nitrogen you need from the food you eat—from plants, or from animals that ate plants.

Phosphorus is the other nonmetal in the nitrogen family. Phosphorus is much more reactive than nitrogen, so phosphorus in nature is always found in compounds. A compound containing phosphorus is used to make matches, because it can react with oxygen in the air.

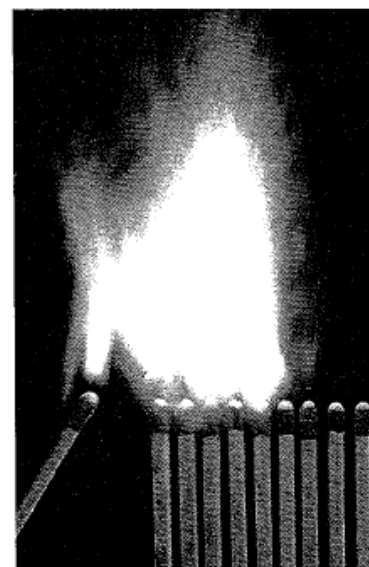
15
7 <b>N</b> Nitrogen
15 <b>P</b> Phosphorus
33 <b>As</b> Arsenic
51 <b>Sb</b> Antimony
83 <b>Bi</b> Bismuth

FIGURE 23

### The Nitrogen Family

Nitrogen and phosphorus are grouped in the same family of the periodic table, Group 15. **Making Generalizations**  
*How do atoms of both these elements change when they react?*

▼ Nitrogen is a key ingredient of fertilizers.





▲ Match heads contain a highly reactive phosphorus compound that ignites easily.



## Lab zone Try This Activity

### Show Me the Oxygen

How can you test for the presence of oxygen?

1.  Pour about a 3-cm depth of hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) into a test tube.
2. Add a pea-sized amount of manganese dioxide ( $\text{MnO}_2$ ) to the test tube.
3. Observe the test tube for about 1 minute.
4.  When instructed by your teacher, set a wooden splint on fire.
5. Blow the splint out after 5 seconds and immediately plunge the glowing splint into the mouth of the test tube. Avoid getting the splint wet.

**Observing** Describe the change in matter that occurred in the test tube. What evidence indicates that oxygen was produced?

**The Oxygen Family** Group 16, the oxygen family, contains three nonmetals—oxygen, sulfur, and selenium. These elements usually gain or share two electrons when reacting with other elements.

You are using oxygen right now. With every breath, oxygen travels into your lungs. There, it is absorbed into your bloodstream, which distributes it all over your body. You could not live without a steady supply of oxygen. Like nitrogen, the oxygen you breathe is a diatomic molecule ( $\text{O}_2$ ). In addition, oxygen sometimes forms a triatomic (three-atom) molecule, which is called ozone ( $\text{O}_3$ ). Ozone collects in a layer in the upper atmosphere, where it screens out harmful radiation from the sun. However, ozone is a dangerous pollutant at ground level because it is highly reactive.

Because oxygen is highly reactive, it can combine with almost every other element. It also is the most abundant element in Earth's crust and the second-most abundant element in the atmosphere. (The first is nitrogen.)

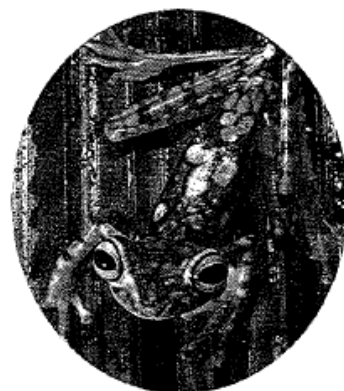
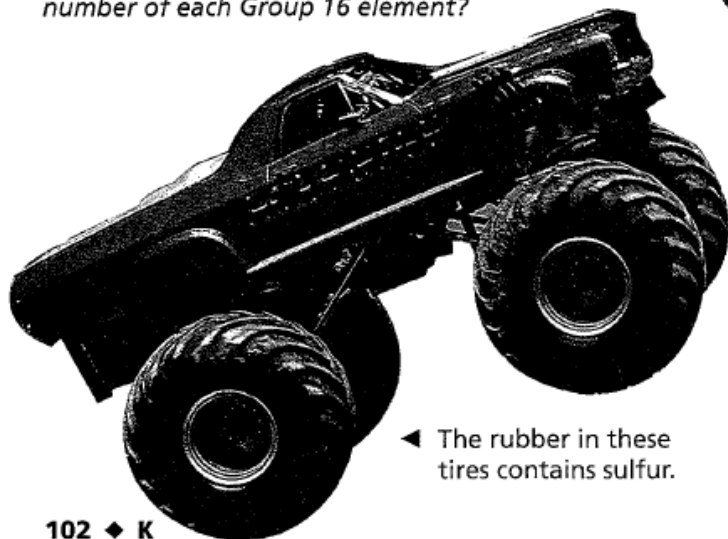
Sulfur is the other common nonmetal in the oxygen family. If you have ever smelled the odor of a rotten egg, then you are already familiar with the smell of some sulfur compounds. Sulfur is used in the manufacture of rubber for rubber bands and automobile tires. Most sulfur is used to make sulfuric acid ( $\text{H}_2\text{SO}_4$ ), one of the most important chemicals used in industry.

FIGURE 24

### The Oxygen Family

Oxygen and sulfur are the most common of the three nonmetals in Group 16.

**Interpreting Tables** What is the atomic number of each Group 16 element?



▲ Some of the oxygen needed by a frog enters through its skin.

16
8
<b>O</b>
Oxygen
16
<b>S</b>
Sulfur
34
<b>Se</b>
Selenium
52
<b>Te</b>
Tellurium
84
<b>Po</b>
Polonium

**The Halogen Family** Group 17 contains fluorine, chlorine, bromine, iodine, and astatine. These elements are also known as the **halogens**, which means “salt forming.” All but astatine are nonmetals, and all share similar properties. A halogen atom typically gains or shares one electron when it reacts with other elements.

All of the halogens are very reactive, and the uncombined elements are dangerous to humans. Fluorine is so reactive that it reacts with almost every other known substance. Even water and powdered glass will burn in fluorine. Chlorine gas is extremely dangerous, but it is used in small amounts to kill bacteria in water supplies.

Though the halogen elements are dangerous, many of the compounds that halogens form are quite useful. Compounds of carbon and fluorine make up the nonstick coating on cookware. Small amounts of fluorine compounds that are added to water supplies help prevent tooth decay. Chlorine is one of the elements in ordinary table salt (the other is sodium). Another salt of chlorine, calcium chloride, is used to help melt ice on roads and walkways. Bromine reacts with silver to form silver bromide, which is used in photographic film.

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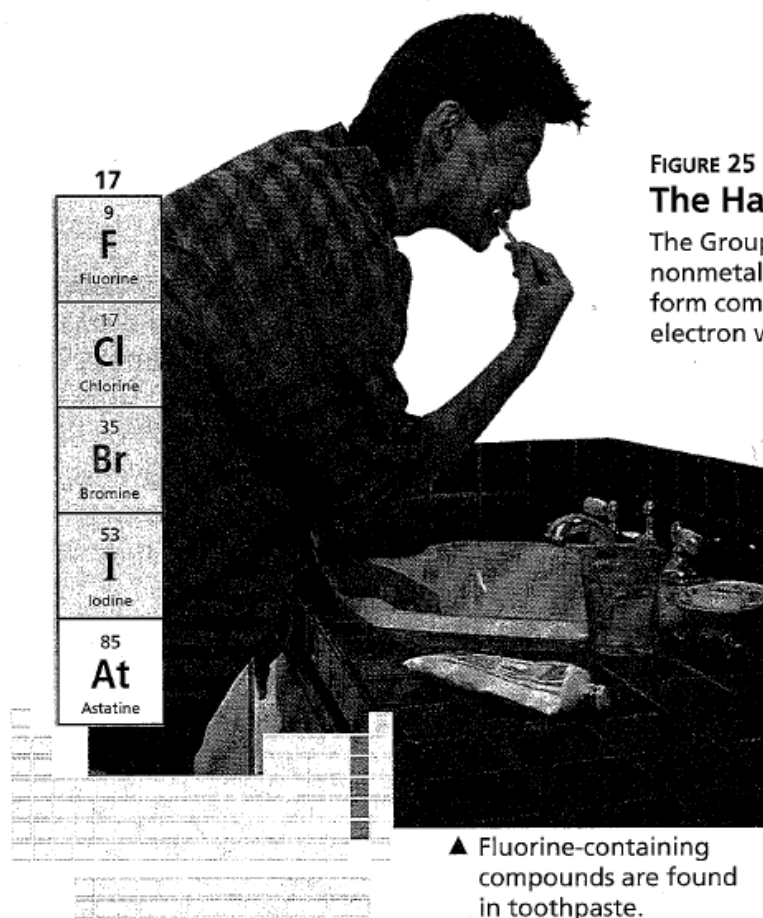


FIGURE 25  
**The Halogens**

The Group 17 elements are the most reactive nonmetals. Atoms of these elements easily form compounds by sharing or gaining one electron with atoms of other elements.



◀ Bromine is highly reactive, and will burn skin on contact.

▲ Fluorine-containing compounds are found in toothpaste.

FIGURE 26

### The Noble Gases

Electricity makes the Group 18 elements glow brightly inside glass tubes. **Applying Concepts** Why are neon and the other noble gases so unreactive?

2	He
10	Ne
18	Ar
36	Kr
54	Xe
86	Rn



**The Noble Gases** The elements in Group 18 are known as the **noble gases**. They do not ordinarily form compounds because atoms of noble gases do not usually gain, lose, or share electrons. As a result, the noble gases are usually unreactive. Even so, scientists have been able to form some compounds of the heavy noble gases (Kr, Xe) in the laboratory.

All the noble gases exist in Earth's atmosphere, but only in small amounts. Because they are so unreactive, the noble gases were not discovered until the late 1800s. Helium was discovered by a scientist who was studying not the atmosphere but the sun.

Have you made use of a noble gas? You have if you have ever purchased a floating balloon filled with helium. Noble gases are also used in glowing electric lights. These lights are commonly called neon lights, even though they are often filled with argon, xenon, or other noble gases.

**Hydrogen** Alone in the upper left corner of the periodic table is hydrogen—the element with the simplest and smallest atoms. Each hydrogen atom has one proton and one electron. Some hydrogen atoms also have neutrons. Because the chemical properties of hydrogen differ very much from those of the other elements, it really cannot be grouped into a family. Although hydrogen makes up more than 90 percent of the atoms in the universe, it makes up only 1 percent of the mass of Earth's crust, oceans, and atmosphere. Hydrogen is rarely found on Earth as a pure element. Most hydrogen is combined with oxygen in water ( $H_2O$ ).

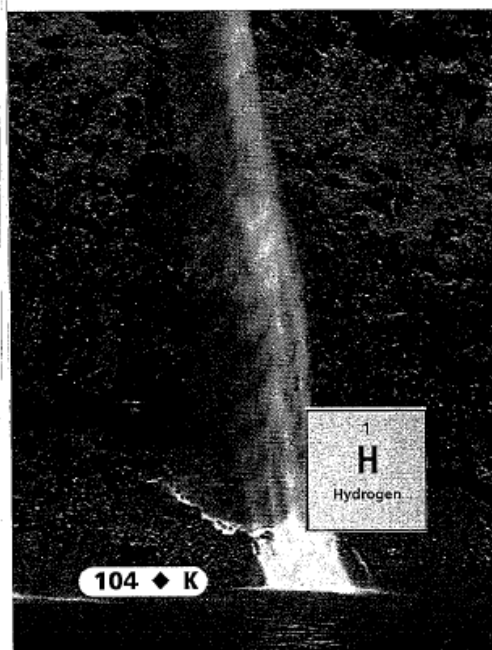


**Reading Checkpoint** Why were the noble gases undiscovered until the late 1800s?

FIGURE 27

### Importance of Hydrogen

Water is a compound of hydrogen and oxygen. Without liquid water, life on Earth would be impossible.



## PERIODIC TABLE FAMILIES

What are periodic table families?

Fill in the following chart

Family	Group(s) on the table	How many electrons do they have in their outer shell?
1. alkali metals		
2. alkali earth metals		
3. transition metals		
4. carbon family		
5. nitrogen family		
6. oxygen family		
7. halogens		
8. noble or inert gases		

Why do elements in the same periodic table families have similar properties and characteristics? (HINT: it has to do with their electrons!)