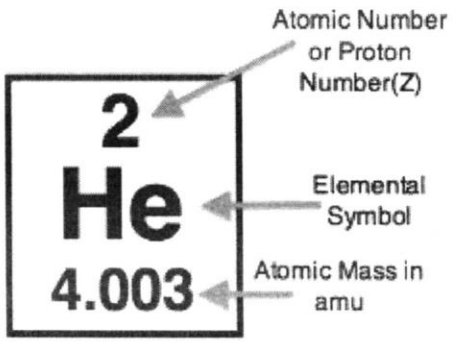
Organization of the Periodic Table Organizing the Elements Brochure



Atomic Number

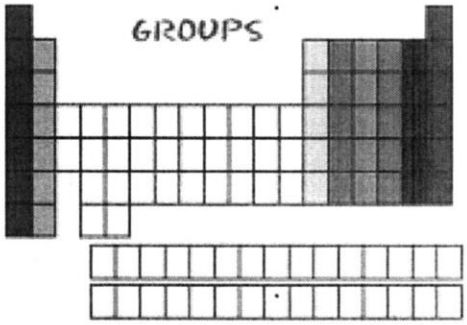
Every element has an atomic number. This is the number of protons in its atom. A proton is a positively charged particle in an atom. For example, the element copper has 29 protons in its atom. If you read the periodic table from left to right and row by row, the atomic numbers will increase in order until you get to number 57. This is because elements 58 – 71 and 90 – 102 appear in order in the two rows at the bottom of the periodic table, which are called the lanthanides and actinides.

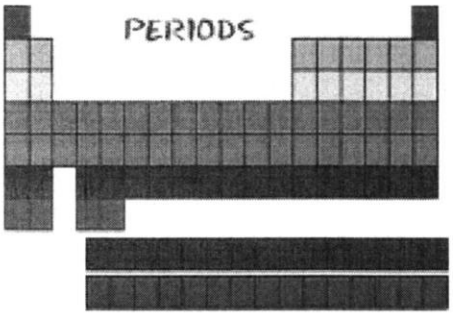
Symbols

Each element is assigned a symbol. The symbol usually corresponds to the element's name. Symbols are usually 2 letters. However, some symbols have one or three letters. The first letter of the symbol is always capitalized and the second letter is always lower case. For example. Fluorine is written as F but Gold is written as Au.

Families

Each vertical column on the periodic table is an element family. There are 18 groups within the periodic table. All of the elements in each family have similar properties. They usually react the same in chemical reactions, and they may even look the same and be used for the same purposes. Each family is numbered and has a name. Most periodic tables show the number; some will even give the name.





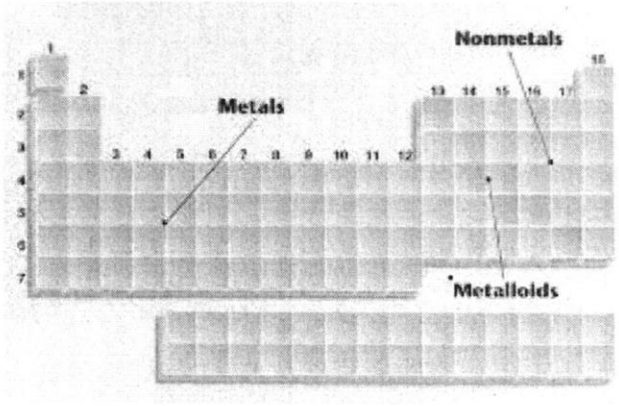
Periods

Each horizontal row is called a period. There are seven periods on the periodic table. The lanthanides and actinides really fit in with the sixth and seventh periods. They have been written at the bottom of the table for convenience.

2

Metals, Nonmetals and Metalloids

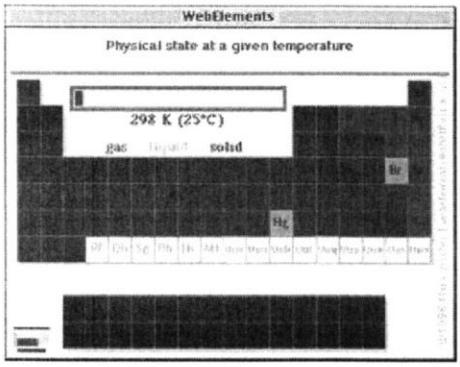
Some periodic tables show a bold line in the shape of steps or a zig- zag line on the right side of the periodic table. All the elements to the left of that line are metals. You can probably see that most of the elements are metals. Metals are elements that are good conductors of heat and electricity. They have a shiny, metallic luster. Metals can also be pounded into shapes (malleable) or drawn into wire (ductile).



All of the elements to the right of the bold zig –zag are called nonmetals. Nonmetals are poor conductors of heat and electricity. They usually have a dull or earthy luster. When pounded, nonmetals usually shatter or form powders.

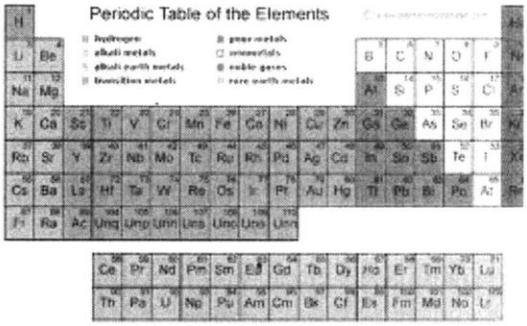
The elements that touch the bold step-shaped line are called metalloids. These elements have characteristics of both metals and nonmetals.

3



Solid, Liquid, or Gas

Some periodic tables even tell us whether an element is a solid, liquid, or gas at room temperature. This is sometimes done by color or by the type of print used. Most elements are solids. There are a few gases. Only mercury and bromine are liquids at room temperature. All elements can be solids, liquids, and gases; it simply depends on the temperature.



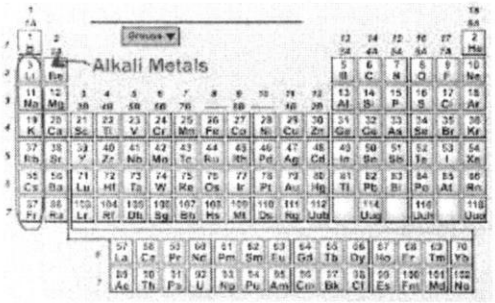
Radioactivity

1. Some elements are radioactive and do not have a stable form. Radioactive means an unstable nucleus spontaneously emits particles and energy in a process known as radioactive decay. The term radioactivity refers to the particles emitted. When enough particles and energy have been emitted to create a new, stable nucleus (often the nucleus of an entirely different element), radioactivity ceases. All the elements with an atomic number of 84 or greater are radioactive. Technetium (43) and promethium (61) also have no stable form. All elements have radioactive forms, and most elements have stable forms. Some periodic tables show whether an element is radioactive or stable.

Natural or Manmade

Most of the elements that we see on the periodic table are natural. This means that they occur somewhere in nature. These are called natural elements. Synthetic elements are elements that are made by humans in laboratories. Many of the heavier elements are synthetic. It was one thought that neptunium (93) and plutonium (94) were synthetic, but now they have been found in small amounts in nature. All of the elements with an atomic number of 95 or greater are synthetic. Some periodic tables show whether an element is natural or synthetic.

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.

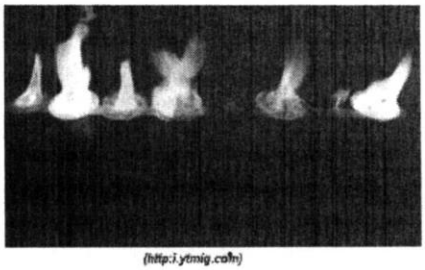
All of the metals in this group are soft, silvery-white metals with low melting points. These metals, along with hydrogen are extremely reactive. Hydrogen will blow up upon any contact with flames. These metals are so reactive that they will burn the skin if touched. They will also tarnish rapidly when in contact with the air. The metals in this family react violently with water. They will easily form salts with the halogens – group 17. They are never found in their pure forms in nature, but are found chemically combined with other elements. 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.

4 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. This family is made up of six metals (beryllium, magnesium, calcium, strontium, barium, and radium).

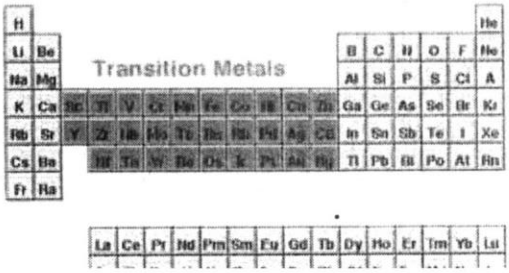
The metals in this family are all soft and silvery-white in color. They have high melting points and high densities. They are very reactive. They will react with water. They can be handled by humans. These metals will oxidize and tarnish when in contact with the air. They are never found in nature in their pure forms, but are found chemically combined with other elements They are good conductors of electricity and heat. 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.



(http://.ytmig.com)

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.

5 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.

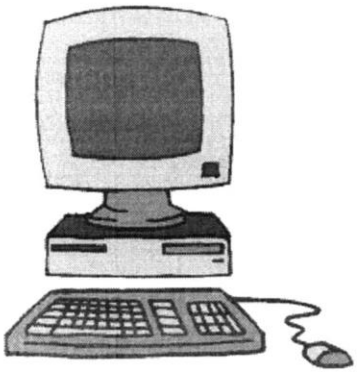
The transition elements are all metals; that's why they are sometimes called the transition metals. Most of the elements in this family are hard, strong, and shiny metals. Most of them have very high melting points and boiling points. Mercury is one exception; it is a liquid at room temperature. Most transition elements are good conductors of heat and electricity. Most transition elements will dissolve when put into 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 (malleable) and drawn into wires (ductile). 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 (a combination of metals blended together), 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, cards, bicycles, cooking utensils, and many other items.. 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.

Groups 13 – 16: The BCNO Family

The BCNO family is found on the right side of the periodic table between the transition elements (groups 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.

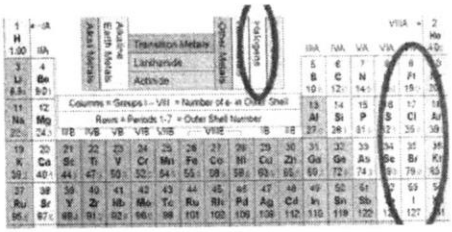
The BCNO family is sometime divided into two or even four separate families. This is by far the most diverse family of elements. The BCNO family is given its name because of the symbols of the lightest elements in each column of the family: boron (B), carbon (C), nitrogen (N), and oxygen (O). The members of this family are metals, nonmetals or metalloids. Some of the 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 with. Most will bond with oxygen. Oxygen will even bond with itself. There are no concrete rules that fit all the elements of this family, except that the members of each column tend to bond with other elements.



There is a wide variety of uses for the BCNO family since this group has 25 members. 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, for example 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 drinking cans, foil, pots and pans.

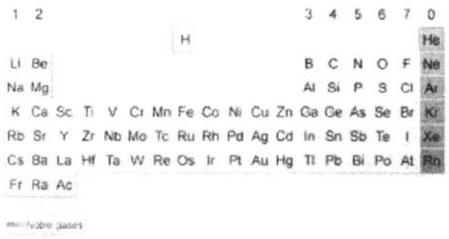
Group 17: Halogen Family

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 one 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, but are found chemically combined with other elements. 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 for form a family of chemical compounds called salts.

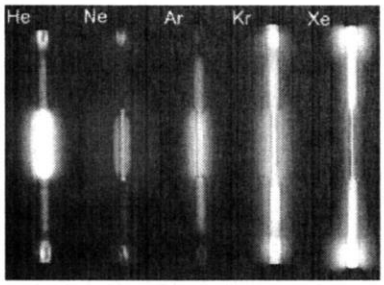
The halogen family has a variety of uses. Fluorine is added to toothpaste and water to prevent tooth decay. Fluorine will combine with uranium to form nuclear fuel. Chlorine is added to water supplies and swimming pools to kill germs. Chlorine is widely used in bleach and salts. Bromine is used as a 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 used as a film developer and as a disinfectant in water supplies. Astatine is very rare, very radioactive, and has no uses



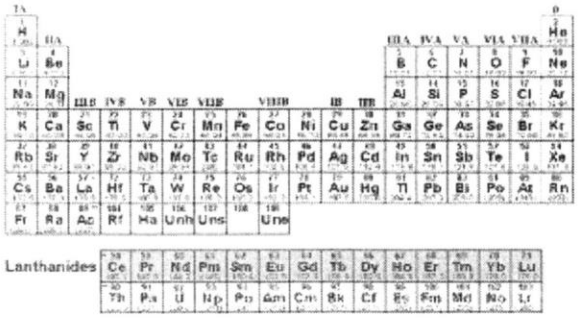
Group 18: The Noble Gases

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 or inert. 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 occur. 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 react with the metals (usually tungsten) that makes up the filament. Radon is radioactive and is used in the treatment of cancer..



The Lanthanide Series

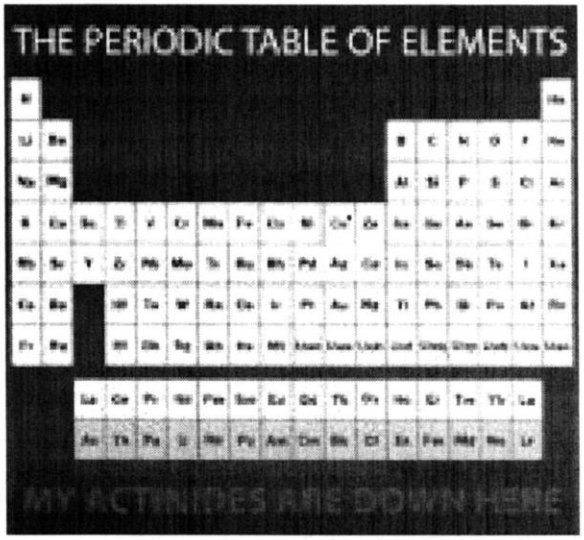
The lanthanide series of elements is found at the bottom of the periodic table. This series appears in the top of the bottom two rows. It consists of 15 elements, including lanthanum.

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 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.

7 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 are 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.

Science 8
Unit: Periodic Table

Name_____
Period _____

Periodic Table Stations Activity

Station 1 : Organization of Periodic Table

1. Atomic number is equal to the number of _____ and these have a positive charge.

2. What happens to the atomic number as you move across the periodic table from left to right?

   _____

   _____

3. Each _____ corresponds to the element's name. The symbols represent a Greek or Latin origin of the element.

4. What are the vertical columns called in the periodic table? _____

5. What do each element in the same group have in common?

   _____

   _____

6. What are the horizontal rows called in the periodic table? _____

7. There are _____ groups and _____ periods on the table.

Station 2 :Metals and Nonmetals

1. Where are the metals located on the periodic table? _____

2. Describe four physical properties of metals.
   a.
   b.
   c.
   d.

3. Where are the nonmetals located on the periodic table? _____

4. Describe four physical properties of nonmetals.
   a.
   b.
   c.
   d.

5. List the names and symbol of four metals below.

   _____ _____

   _____ _____

6. Write the group number next to each metal above.

Station 3: Properties of the Periodic Table

1. A periodic table can tell you if an element is a _____, _____ or gas.

2. Most elements are _____ at room temperature.

3. What makes mercury and bromine different than the rest of the elements?

   _____

   _____

4. What effect does temperature have on an element?

   _____

   _____

5. What does radioactive mean? _____

6. Where are these elements located on the periodic table? _____

7. Elements on the periodic table can either be _____ or _____.

Station 4: Alkali Metals and Alkaline Earth Metals

1. What group are the alkali metals found on the periodic table? _____

2. What elements are considered to be alkali metals?

_____

_____

3. Describe 3 properties of alkali metals.
   a.

   b.

   c.

4. What do hydrogen and alkali metals have in common?

_____

_____

5. What group are the alkaline earth metals found on the periodic table? _____

6. Describe 3 properties of alkaline earth metals.
   a.

   b.

   c.

7. List 3 properties that alkali metals and alkaline earth metals have in common.
   a.

   b.

   c.

Station 5 : Transition Elements and BCNO Family.

1. Where are the transition elements found on the periodic table? _____

2. How many elements are in this group? _____

3. List 3 properties of the transition elements.
   a.

   b.

   c.

4. List some ways that the transitional metals are used everyday.

   a.

   b.

   c.

5. How did the BCNO family get its name?

_____

_____

6. The members of this family are _____, _____ and _____.

7. List some ways that the BCNO families are used everyday.
   a.

   b.

   c.

   d.

Station 6 :Group 17 –Halogen Family and Group 18 – Noble Gases

1. Where are the halogens located on the periodic table? _____
2. Halogen reactive decreases _____.
3. At room temperature the Halogen family
   a. Fluorine and chlorine –
   b. Iodine and astatine –
   c. Bromine –
4. Halogens generally form _____ with the alkali metals.
5. What group number is the noble gases ? _____
6. Why are the noble gases considered "inert"?
   _____
   _____
7. What state of matter do all noble gases exist? _____
8. Name the noble gases and their symbols.