

Name _____
 Period: _____ Date: _____

Unit 3: Introduction to the Periodic Table

"Everything has beauty, but not everyone sees it." Confucius

HISTORICAL DEVELOPMENT

Father of the Periodic Table

Dmitri Mendeleev (1834-1907) –in 1869 Mendeleev published a table of the elements arranged by increasing atomic mass. At the time there were only 60 known elements.

Important consequences of this periodic arrangement of elements-

1. Elements were grouped together for the first time by similar properties.
2. To keep elements with the same properties in the same groups, spaces or blanks had to be left.
3. Mendeleev hypothesized that these spaces represented unidentified elements. A search for these elements begins and results in 115 known elements today.

Father of the Modern Periodic Table

Henry Moseley (1887-1915) –in 1913, through his work with x-rays, Moseley discovers the actual nuclear charge of the elements, which we now call atomic numbers. Moseley then rearranges the periodic table by increasing atomic number. This is the periodic table we use today- the modern periodic table.

*"There is in the atom a fundamental quantity which increases by regular steps as we pass from each element to the next. This quantity can only be the charge on the central positive nucleus."
 -Henry Moseley

ORGANIZATION

- **Periods** – horizontal rows, "side to side" There are 7 periods on the periodic table.

Example: Sodium (Na) and Magnesium (Mg) are in the same period.

- **Groups or Families** – vertical columns, "up an down". Elements in the same group have similar properties!!! ← Group 18

Example: Sodium (Na) and Potassium (K) are in the same group.

Legend:

- Atomic number: 6
- Symbol: C
- Atomic weight: 12.01
- Metal: Pink
- Semimetal: Green
- Nonmetal: Yellow

Labels on table: METALS, NONMETALS, METALLOIDS

Period 4 label on the left side of the table.

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- **Metals** – found to the left of the "stair step" with the exception of Hydrogen; 80% of elements are metals. These elements conductors of heat and electricity, **ductile** (can be drawn into wires), and **malleable** (can be hammered into thin sheets)
- **Nonmetals** – found to the right of the "stair step" These elements are POOR conductors of heat and electricity (except carbon), and tend to be brittle, meaning they will shatter if hit with a hammer.
- **Metalloids (Semimetals)** – touch the "stair step" with the exception of Aluminum. These elements have properties of both metal and nonmetals. Metalloids only conduct electricity under certain conditions, which make them useful in the semi-conductors industry.

A Closer Look at the Groups (Families)

- Note- Not all of the groups have been given names. The following gives information on the groups *with* names.

Group 1: The Alkali Metals

Alkali metals - highly reactive metallic elements which form *alkaline* solutions in water, burn in air, and belong to group 1 of the periodic table. They are Lithium, Sodium, Potassium, Rubidium, Cesium, and Francium (NOT Hydrogen). They are all highly reactive and are never found in elemental form in nature. As a result, in pure form they must be stored under mineral oil.

Group 2: The Alkaline Earth Metals

Alkaline-earth metals - reactive, metallic elements which belong to group 2 of the periodic table. They are Beryllium, Magnesium, Calcium, Strontium, Barium, Radium. They are also usually not found in elemental form in nature because of their reactive nature. However they are not as reactive as the alkali metals..

Group 3-12: The Transition Elements

Transition Metals - metallic elements that have varying properties and belong to group 3 through 12 of the periodic table

Inner Transition Elements- The inner transition metals are the two rows of elements that appear below the main body of the periodic table.

Lanthanides - shiny, metallic elements with atomic numbers 57 through 71.

Actinides - metallic elements with atomic numbers 89 through 103.

Groups 13-15

These families really don't really have names but are sometimes referred to by the following:

Group 13- The Boron Family

Group 14- The Carbon Family

Group 15- The Nitrogen Family

Group 16: The Chalcogens

Chalcogens are all nonmetals. They are Oxygen, Sulfur, Selenium, Tellurium, and Polonium.

The chalcogens (with the "ch" pronounced with a hard "c" as in "chemistry") are the name for the periodic table group 16 in the periodic table. It is sometimes known as the oxygen family.

The name is generally considered to mean "ore former" from the Greek *chalcos* "ore" and -gen "formation". Oxygen, sulfur, and selenium are nonmetals, and polonium and tellurium are metalloid semiconductors

Group 17: The Halogens

Halogens - elements that *combine with most metals to form salts** and that belong to group 17 of the periodic table. Contains elements Fluorine, Chlorine, Bromine, Iodine, and Astatine.

These elements are diatomic molecules in their natural form.

Halogens are highly reactive, and as such can be harmful or lethal to biological organisms in sufficient quantities. Fluorine is the most reactive element in existence, even attacking glass, and forming compounds with the heavier noble gases. It is a corrosive, highly toxic gas. Chlorine and iodine are both used as disinfectants for such things as drinking water, swimming pools, fresh wounds, dishes, and surfaces. They kill bacteria and other potentially harmful microorganisms, a process known as sterilization. Their reactive properties are also put to use in bleaching. Chlorine is the active ingredient of most fabric bleaches and is used in the production of most paper products.

*Salt: A generic term which scientifically refers to a compound made up of a metal and nonmetal.

Group 18: The Noble Gases

Noble gases - consists of gaseous, unreactive elements. They are Helium, Neon, Argon, Krypton, Xenon, and Radon. The noble gases were previously referred to as **inert gases**, but this term is not strictly accurate because several of them *do* take part in chemical reactions. All of them exhibit an **extremely** low chemical reactivity, in fact no compounds with helium or neon have yet been prepared.

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PERIODIC TABLE PRACTICE

(YOU WILL NEED YOUR PERIODIC TABLE FOR THIS ASSIGNMENT)

MULTIPLE CHOICE:

- _____ 1. The characteristics of oxygen are most similar to the characteristics of—
A Hydrogen B Silicon C Helium D Sulfur
- _____ 2. Calcium ions play an important role in the function of neurons in the brain. Elements that are chemically similar to calcium can interfere with the function of neurons. Which of the following is most likely to imitate calcium's role in the function of neurons?
F Sodium G Potassium H Strontium J Rubidium
- _____ 3. A certain atom has a nucleus containing six protons and eight neutrons and has six electrons orbiting the nucleus. This atom is a form of the element—
A Silicon B Carbon C Magnesium D Calcium
- _____ 4. Alpha particles are one type of radioactivity. These particles have a nucleus of two protons and two neutrons but have no orbital electrons. Based on this information, it can be inferred that alpha particles are positive ions of the element— (Hint: Use the number of the subatomic particle that identifies elements and find it on the periodic table)
F Actinium G Curium H Radium J Helium
- _____ 5. Which of the following groups contains members with similar chemical reactivity?
A Li, Be, C B Be, Mg, Sr C Sc, Y, Zr D C, N, O
- _____ 6. Which of the following pairs of elements belong to the same **period**?
F Na and Cl G Na and Li H Na and Cu J Na and Ne
- _____ 7. Which of the following pairs of elements belong to the same **group**?
A H and He B Li and Be C C and Pb D Ga and Ge

SHORT ANSWER: Answer each of the following questions. You need not use complete sentences.

8. By what property did Mendeleev arrange the elements? _____
9. By what property did Moseley suggest that the periodic table be arranged? _____
10. List, by number, both the period and group of each of these elements.
- | | <u>Symbol</u> | <u>Period</u> | <u>Group</u> |
|--------------|---------------|---------------|--------------|
| a. beryllium | Be | | |
| b. iron | Fe | | |
| c. lead | Pb | | |
11. List the symbols for the alkaline earth metals: _____
12. List the symbols of the three lightest members of the noble gases. 1. _____ 2. _____ 3. _____
13. Which alkali metal belongs to the sixth period? _____
14. Which halogen belongs to the fourth period? _____
15. Where, generally, are the metals located on the periodic table? _____
16. Where, generally, are the nonmetals located on the periodic table? _____
17. List two ways metal are different from nonmetals.