

Chapter 3-2 Using the Periodic Table

- I. Important People to Remember
 - a. Dmitri Mendeleev -given credit for discovery of the periodic table.
 - b. Henry Moseley-revised Mendeleev's table using atomic number.
- II. Overview of the P.T.
 - a. Groups
 - i. A series of element that form a vertical column
 - ii. 18 groups
 1. Alkali Metals-
 2. Alkaline Earth Metals
 3. Transition Metals
 4. Halogens
 5. Noble gases
 - iii. Elements within a group have the same number of valence electrons, as well as other characteristics.
 - b. Periods
 - i. A series of elements that form a horizontal row in the periodic table.
 - ii. 7 periods
 - iii. Each element within a period has one more proton/electron than the element directly to its left.
 - iv. Elements within a period all share the same valence level.
 - c. Metallic elements
 - i. Metals make up much of the periodic table, found in groups 1-16
 - ii. Metals are solid at room temperature, except mercury
 - iii. Metals are good conductors of heat and electricity
 - iv. Metals are silver in color except copper, and gold
 - v. Metals are malleable-they can be flattened out into thin sheets
 1. Aluminum foil, gold leaf, nickel plating
 - vi. Metals are ductile-they can be drawn into wire
 1. Copper wire, aluminum wire
 - vii. In a group of metallic elements, the reactivity will increase as we move down through the periods.
 - d. Nonmetallic Elements

- i. Nonmetals are a much smaller group, found in groups 14-18
 - 1. Hydrogen is also considered a nonmetal
 - ii. Nonmetals are naturally found in all 3 states of matter.
 - 1. Bromine is a liquid, oxygen, fluorine, argon are all gases, and carbon is a solid.
 - iii. Nonmetals are poor conductors of heat and electricity.
 - 1. They are often used as insulators
 - iv. Reactivity of nonmetals decreases as we move down through the periods.
 - e. Semi-metallic elements
 - i. Also known as metalloids or semiconductors
 - ii. These elements are found in between the metallic and nonmetallic elements.
 - 1. They form what is often called the stair step
 - iii. The semiconductors have properties of both metals and nonmetals
 - 1. They often conduct electricity but do not transfer heat with it, therefore they are often used in electronic devices.
- III. The Main Group Elements
 - a. Groups 1 and 2, 13-18
 - i. Group 1-Alkali Metals
 - 1. Elements are very soft, can be cut with a knife
 - 2. Rarely found in pure form in nature
 - 3. React quickly with oxygen, must be stored under oil to prevent reactions with the air.
 - 4. Have 1 valence electron, they always want to lose their valence electron when bonding.
 - a. They form a cation with a charge of +1
 - 5. As we move down through the group reactivity increases.
 - a. Francium is the most reactive metal on the P.T.
 - 6. Elements like sodium and potassium are essential for life
 - 7. REMEMBER HYDROGEN IS NOT AN ALKALI METAL!
 - ii. Group 2-Alkaline Earth Metals

1. The name alkaline is used because when these metals combine with water the pH of the solution is usually greater than 7.
2. These metals are denser, more firm, and have higher melting points than the alkali metals.
3. Each of the metals have 2 valence electrons, they want to lose both, and will react quickly to form cations with a charge of +2.
4. Magnesium and Calcium are essential for life

iii. Group 17-The halogens

1. Most reactive group of nonmetallic elements, each of them is diatomic in their pure form.
 - a. F_2 , Cl_2 , Br_2 , I_2
2. Halogens most often combine with alkali metals to form salts
 - a. $LiCl$, $NaCl$, KCl ,
3. All members have 7 valence electrons and will easily gain 1 more to achieve a stable octet. They form anions with a charge of -1.
4. Fluorine is the most reactive nonmetal on the P.T.

iv. Group 18- The Nobel Gases

1. This group of elements is very unreactive, because they all have a stable valence shell.
 - a. Helium-has only 1 energy level so its happy with 2
 - b. All others have 8 valence electrons-they are happy
2. Helium is used in balloons and for industrial purposes, neon and argon are used for lighting.

IV. Non-main group elements

a. Transition metals-groups 3-12

- i. Most transition elements can form ions with different charges depending on conditions.
 1. Copper forms a Cu^{+1} or Cu^{+2}
 2. Chromium forms a Cr^{+3} or Cr^{+6}
 3. The only exceptions to the rule are silver Ag^{+1} , Zinc Zn^{+2} , and Cadmium Cd^{+2}

b. Lanthanides and Actinides

i. The bottom two rows of transition elements.

1. Lanthanides

- a. Often called the inner transition elements or the rare-earth metals.
- b. Used for a variety of industrial uses such as glass making, lasers, and super conductors.

2. Actinides

- a. Most of these guys are radioactive, their nuclei are very unstable. Very few are found naturally on earth.
- b. Most common are uranium and plutonium both used for nuclear power reactions

V. Summary

- a. The periodic table is a useful tool, but knowledge of atomic structure is key to understanding how the table is built and how matter essentially behaves.
- b. The patterns within the table allow us to predict what will happen to the electrons of a particular atom.
 - i. The study of chemistry focuses on what happens to the electrons of the atoms involved in a chemical reaction.
 - ii. All chemical reactions involve a rearrangement of electrons