Basic Chemistry Notes

New substances are always produced during chemical bonding. Chemical bonding occurs during a chemical reaction.

Not all electrons in an atom are involved in chemical bonding. Usually, only the outer electrons (**valence electrons**) are involved.

The **valence number** of an element is the number of electrons that will be gained, lost, or shared when chemical bonding takes place.

Group VIIIA, the "**noble gasses**" (inert gasses) are chemically inactive. They do not form chemical compounds easily because their outside energy levels are full (they have the maximum number of electrons).

All atoms have two (2) electrons in the first energy level except hydrogen which only has a total of one electron. Two is the maximum number of electrons that can exist in the 1st energy level.

All atoms with a total number of 10 electrons or more have 8 electrons in the 2nd energy level. Eight is the maximum number of electrons that can exist in the 2nd energy level.

The maximum number of electrons in the outside energy level is eight (8).

Groups IA, IIA, IIIA, IVA, VA, VIA, VIIA, and VIIIA have 1, 2, 3, 4, 5, 6, 7, and 8 electrons correspondingly in their outer energy levels (except helium, He, which only has two electrons total.). Electrons in the outermost energy level are called valence electrons.

For example: All group **VIA** elements have **six valence electrons.**

Ionic bonding results when electrons are transferred from one atom to another to form a compound.

Ionization energy is the amount of energy necessary to remove a valence electron from a neutral atom.

Covalent bonding results when electrons are shared between atoms of a compound. The shared electrons are simultaneously attracted by the nuclei of the atoms involved in the bond.

Covalent bonding results in particles called **molecules**.

When atoms of a nonmetal bond with the atoms of another nonmetal, the atoms usually **share** electrons to form molecules.

Ions are charged particles. Many ions are atoms or groups of atoms that have lost or gained electrons so that they are no longer electrically neutral.

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Ions are created when electrons are lost or gained by atoms or other particles. Ions are created during ionic bonding. The atoms that lose electrons become positive ions. The ions that gain electrons become negative ions. The oppositely charged ions are then attracted to each other by electromagnetic force.

The tendency to attract electrons is called "**electron affinity**".

The process in which electrons are removed from or added to the outside energy level of an atom is called **ionization**.

Metals tend to lose electrons easily. When a metal bonds with a nonmetal, the metallic atom loses an electron (or electrons) to the nonmetallic atom.

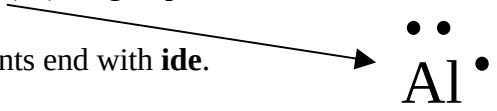
When a metallic atom bonds with another metal, the bond that results is a **metallic bond** in which **all of the atoms share their outer electrons**. The valence electrons are free to move easily throughout the piece of metal because they are only weakly attracted by the nuclei of the metal atoms. A metallic bond is often described as positively charged metal ions surrounded by a "sea" of highly mobile electrons.

Metallic bonds between metal atoms are responsible for **ductility**, **malleability**, **conductivity** and **luster**.

Polyatomic ions are "ionized" particles composed of many atoms which have an overall charge (positive or negative) and act as a single atom in some chemical reactions. (See the chart of oxidation numbers for polyatomic ions on the back of the periodic table handout.).

Electron dot diagrams are element symbols with dots placed around the outside to represent the "valence" electrons. For example, aluminum (Al), in group IIIA, has 3 valence electrons.

Names of compounds containing only two elements end with **ide**.



The **diatomic elements** are hydrogen, nitrogen, oxygen, fluorine, chlorine, bromine & iodine. **These elements exist as molecules of two atoms covalently bonded**.

(H_2, N_2, O_2, F_2, Cl_2, Br_2, & I_2)

The **oxidation number** of any atom represents the number of electrons the atom gains, loses, or shares when it forms a chemical bond.

In a correct chemical formula for a stable compound, the **sum of the oxidation numbers** of the atoms in a compound must be **zero**.

Chemical formulas are balanced using "**oxidation numbers**" and "**subscripts**".
For example, when combining hydrogen and oxygen to make water we end up with H_2O, but how do we know that H_2O is the correct formula? Using oxidation numbers (from the oxidation number chart handout) we find the following situation.

$^{1+}\ ^{2-}$ $^{1+}$
H O H_2O

unbalanced **balanced**

Since the oxidation numbers in a balanced formula must total zero, we simply use the subscript 2 to increase the hydrogen atoms and balance the formula.