

Bonding: what is required?

It is important to talk about valence electrons, or the outermost or highest energy level electrons. They are numbered from 1 to 8, never more than 8. For [H] and [He] the max is 2. Given by *Group A* elements. Represented by Lewis Dot Diagrams (structures or symbols), (for individual atoms or showing bonds formed).

### Some Rules About Bonding

- 1) Bonds only involve the Valence Electrons.
- 2) Valence electrons are the highest energy electrons, not necessarily the last to fill.
- 3) Valence electrons only include the *s* and *p* subshells for any particular energy level; therefore the number of valence electrons always goes from **one to eight!**
- 4) All other atoms (other than Noble Gases) desperately want to be like a Noble Gas, i.e. have the electron configuration of a Noble Gas, or to have a full valence level (up to 8 electrons). We call this the **Octet Rule**. This makes them really stable.
- 5) Atoms don't like having electrical charge. They absolutely abhor it.
- 6) Atoms will gain or lose electrons to achieve this goal, but acquire charge. Satisfies rule five by forming bonds. Atom may be charged, but entire molecule should not be.
- 7) There is ever and only one ionic bond, regardless of the number of atoms involved or charges involved. There is

just The Ionic Bond. Ionic bonds form by the attraction of mutually opposite charges.

- 8) Covalent bonds form by sharing pairs of electrons, so no charges but Octet Rule satisfied. Since a covalent bond involves a pair of electrons and no more, you can actually have more than one (single, double, triple).
- 9) An “ideal” covalent bond has exactly a shared pair of electrons, one electron is donated by each atom in the bond, they orbit in a figure 8 pattern, they orbit as a pair around the nucleus of each atom in the bond, they spend half their time (50% - 50%) around each atom (actual time or proportion of orbit length, either way), no atom has more claim to the electrons than the other. However, only works if the electron affinity of both atoms is identical; which will only be the case if the atoms are exactly the same element.

## **Types of Bonds**

### **Rule 1**

Ionic bond = between a metal and a metal, or between a metal and a nonmetal.

Covalent = between a nonmetal and another nonmetal.

### **Rule 2**

Polar Covalent Bond = a covalent bond between two atoms of different elements.

Non-Polar Covalent Bond = a covalent bond between two atoms of the same element.

## Some Additional Notes on Ionic Bonds

There are two types of chemical bonds: Ionic and Covalent.

Ionic bonds are formed between ions and compounds formed by ionic bonds are called ionic compounds.

Ion = an electrically charged particle, either positive or negative.

How to determine the formula for an ionic compound:

1. Always possess an positive and negative component; a cation and an anion, the cation (or positive part) is always written first
2. Ions will bond together in whole number ratios so their total electrical charge is neutral (while ions have charge, the molecule as a whole does not)