

Key:  
 $e^-$  = Electron  
 b/c = Because

Chemistry (Math Notes)

Module #4

Ionic Molecule Formation

Ionic molecules form when atoms Give up electrons and other atoms take them. These molecules are made up of ions and function like Magnets.

Metals tend to Give up electrons. They become Positively charged.

Nonmetals tend to take electrons. They become Negatively charged.

The Periodic Table can help to determine these charges. (See attached)

EXAMPLE: K (potassium) and F (fluorine)

K is positive      F is negative

$K^{+1}$                        $F^{-1}$

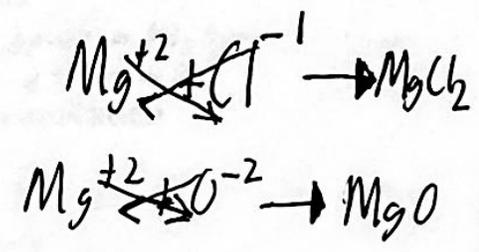
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$        $1s^2 2s^2 2p^5$

Wants  $8e^-$  in outer shell      Wants  $8e^-$  in outer shell

More Positive

$K \cdot \quad \cdot F \cdot$

$K^{+1} - 19$   
 $F^{-1} - 10$

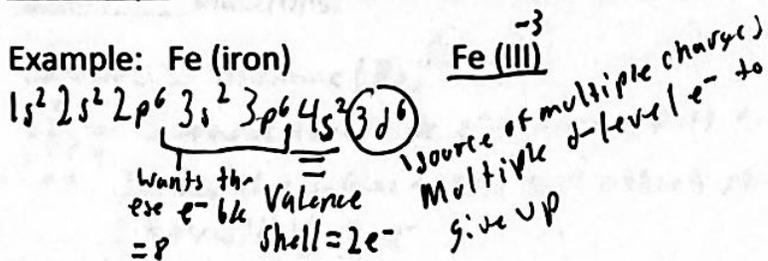


Steps to Determine Ionic Formulas

1. Determine the charge that the ion will have to get ideal electron configuration (    valence electrons).
2. Drop the +/- signs and switch those #s; these become the subscripts for the formula.
3. Subscripts must be reduced to lowest possible ratio, because all

Chemical formulas have the lowest possible ratio.

There are some exceptions, which are the Transition Metals because they can have many charges. All transition metals have only 2 valence electrons and s is the last energy level. A Roman Numeral will indicate the charge on the metal.



### Ionization Potential

Ionization Potential is defined as The amount of energy needed to take an e<sup>-</sup> away from an atom. (Non-metals have a higher ionization potential because a non-metal is harder to take an e<sup>-</sup> from.)  
A Non-metal is harder to take an electron from, so its ionization potential is higher.

Electronegativity is defined as The measure of how strongly an atom attracts its e<sup>-</sup>. (Non-metals have higher e<sup>-</sup> negativity b/c they are smaller and want e<sup>-</sup>.)  
Non-metals are smaller and want an electron; they will attract more strongly.

Atomic Radius is defined as The size of an atom from its nucleus to its outer shell.

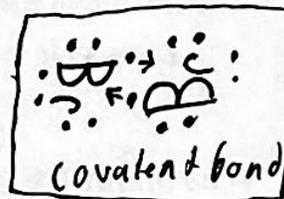
[Non-metals have smaller radii; they pull their e<sup>-</sup> closer to their nuclei, since they are closer to having a full octet (8 valence e<sup>-</sup>)]  
Non-metals will pull the electrons closer to the nucleus because they are getting closer to having a full octet; their radius becomes smaller.

All of these properties can be noted on the Periodic Table (see attached).

## Covalent Compounds

Two nonmetals both have high electronegativity and do not have enough of a difference to give and take electrons from one another, so they share electrons.

EXAMPLES: Bromine (Br) <sup>⊖</sup>  
 $\cdot\dot{\text{Br}}\cdot$  Bromine needs one  $e^-$  to have a full octet.  
 $\cdot\cdot$  So, 2 will combine to fill each other's shell.  
 They will share  $e^-$ .



This is why we have homonuclear diatomics.

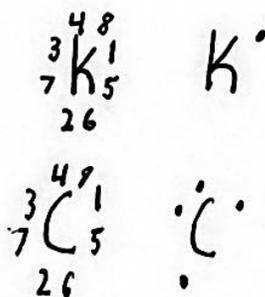
## LEWIS STRUCTURES

A Lewis Structure is defined as a Schematic representation of the Valence Electrons in an atom or molecule.

The Pattern for the Lewis Structure of an element:

1. Find # valence electrons for the element.
2. Put one dot for each valence electron around the element symbol.
3. Start on the right & go clockwise.

4 8  
 3 symbol 1  
 7 goes here 5  
 2 6



### **The Pattern for the Lewis Structure of a Compound**

1. Write out the chemical formula. List how many valence electrons there are for each element in the compound. List how many total valence electrons there are.
2. Pick a central atom (the element further to the left on P.T./atom with the most unpaired electrons. Put it in the center. (If there is more than one of those atoms for the element, place them all in the center and linked together). Carbon and Silicon always go in the center; Hydrogen always goes on the outside; column 7A is almost always on the outside.

NOTE: HYDROGEN WANTS 2 electrons.

3. Arrange other atoms on the outside and connect to central atom with one bond.
4. Fill in octets on outside atoms first.
5. If central atom is not full with 8 electrons, then place multiple bonds between center atom and an outside atom until center atom has access to 8 electrons.