

## More Chemical Bonding

### Bonding Review

Most elements react to form compounds. Elements do this to gain a full set of valence electrons (Octet Rule—“If I 8 I full”).

**Ionic Compounds** occur between metals and non-metals because metals become *cations* (positive ions) and non-metals become *anions* (negative ions). And opposites attract.

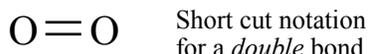
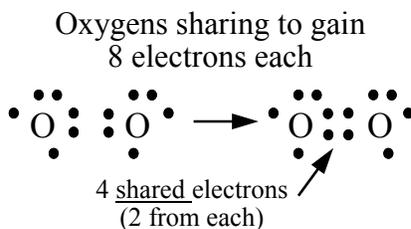
Opposites attract



Cross the number not the sign to get:

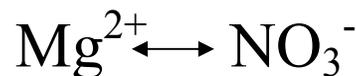


**Covalent Compounds** occur between non-metals. Because neither element will give up their electrons (too many protons), they share electrons to complete the full set of 8.



**Polyatomic Compounds** are compounds with 3 or more elements. These are just large ionic compounds. They happen because sometimes when two elements react they don't fulfill the octet rule and end up with a net electrical charge.

Big opposites attract, too



### Ionic, Covalent, or Polyatomic?

$\text{K}_2\text{O}$  \_\_\_\_\_  
(Potassium oxide)

$\text{AlF}_3$  \_\_\_\_\_  
(Aluminum fluoride)

$\text{Li}_2\text{CrO}_4$  \_\_\_\_\_  
(Lithium chromate)

$\text{Ca}_3\text{N}_2$  \_\_\_\_\_  
(Calcium nitride)

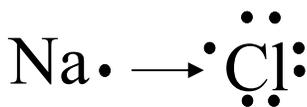
$\text{CO}_2$  \_\_\_\_\_  
(Carbon dioxide)

$\text{MgCO}_3$  \_\_\_\_\_  
(Magnesium carbonate)

$\text{SiCl}_4$  \_\_\_\_\_  
(Silicon tetrachloride)

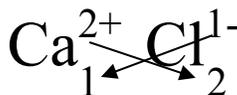
$\text{NaCl}$  \_\_\_\_\_  
(Sodium chloride—table salt)

Use dot diagrams like puzzle pieces.  
For ionic compounds remember that the metal is actually *losing* the electron to the non-metal.



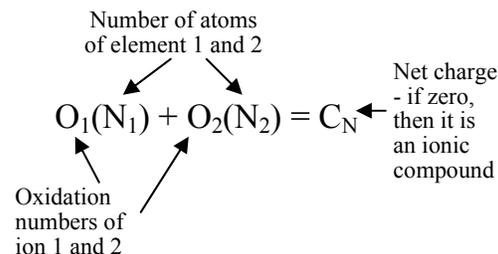
### Making Ionic Compounds

Or use the “cross the number not the sign” method:



This compound will be stable because the net charge is zero.  
 $1(2) + 2(-1) = 2 - 2 = 0$

Ionic compounds are balanced if the net charge is zero. Use this formula:



#### Make Balanced Ionic Compounds

Li and N

Ca and O

Al and Cl

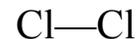
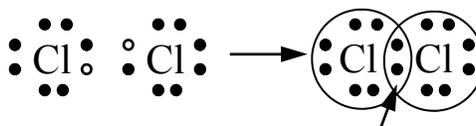
Na and Ne

Using the formula above show that  $\text{Na}_2\text{O}$  is balanced.

### Covalent Bonds—Diatomic Molecules

Diatomic molecules have 2 atoms of the same element. N, O, F, Cl

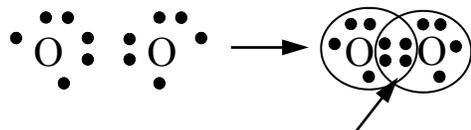
Seeing how covalent bonds connect together is easy for single bonds, like chlorine. Yet it can be hard to see for triple bonds like Nitrogen. For compounds it can get even more difficult.



Sharing one electron each

Short cut notation for a *single* bond.

Each oxygen needs 2 more electrons.



Sharing 2 electrons each

*Each line stands for a shared pair of electrons: 1 from each*



Short cut notation for a *double* bond.

Draw the covalent bond between two Bromine atoms:

Draw the covalent bond between two Fluorine atoms:

*Two Tricks—*

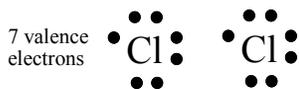
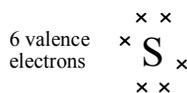
1) If you cover one of the atoms up with a piece of paper (or a finger) you can see if the other atom has the necessary 8 electrons.

2) The number of extra electrons you need to make 8 goes on the sharing side of the chemical symbol. Ex. Nitrogen has 5 valence electrons and needs 3 more to be full, so put 3 electrons on the side toward the other N.

When trying to figure out covalent compounds, it may take some time and creativity. Remember to look at the atoms as puzzle pieces.

### Covalent Compounds

Ex. Make Sulfur Dichloride ( $\text{SCl}_2$ )

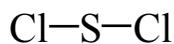


Tip: it can help to draw the electrons differently (like x's and o's) for the different elements. This can help you keep track from where the electrons came.

Move them around until each atom has 8 electrons by sharing.



*Short hand notation*



Each bar is a shared electron pair

Draw the covalent compound of  $\text{CO}_2$ :

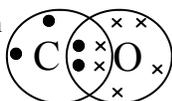
Draw the covalent compound of  $\text{NF}_3$ :

Draw the covalent compound of  $\text{CH}_4$  (methane):

Make Carbon monoxide ( $\text{CO}$ )



Carbon has only 6



Oxygen needs 2 more electrons, but carbon needs 4. Either oxygen will have too many, or carbon will have too few.

This is why  $\text{CO}$  is an unstable, poisonous compound! It will react with oxygen in your body to form  $\text{CO}_2$  and could kill you!