Naming Molecular Compounds

How are the chemical formula and name of a molecular compound related?

Why?

When you began chemistry class this year, you probably already knew that the chemical formula for carbon dioxide was CO_2. Today you will find out why CO_2 is named that way. Naming chemical compounds correctly is of paramount importance. The slight difference between the names carbon monoxide (CO, a poisonous, deadly gas) and carbon dioxide (CO_2, a greenhouse gas that we exhale when we breathe out) can be the difference between life and death! In this activity you will learn the naming system for molecular compounds.

Model 1 – Molecular Compounds

Molecular Formula	Atoms of First Element	Atoms of Second Element	Name of Compound
ClF			Chlorine monofluoride
ClF_5	1	5	Chlorine pentafluoride
CO			Carbon monoxide
CO_2			Carbon dioxide
Cl_2O			Dichlorine monoxide
PCl_5			Phosphorus pentachlroride
N_2O_5			Dinitrogen pentoxide

1. Fill in the table to indicate the number of atoms of each type in the molecular formula.
2. Examine the molecular formulas given in Model 1 for various molecular compounds.
   a. How many different *elements* are present in each compound shown?

   b. Do the compounds combine metals with metals, metals with nonmetals, or nonmetals with nonmetals?

   c. Based on your answer to *b*, what type of bonding must be involved in molecular compounds?

3. Find all of the compounds in Model 1 that have chlorine and fluorine in them. Explain why the name “chlorine fluoride” is not sufficient to identify a specific compound.

4. Assuming that the name of the compound gives a clue to its molecular formula, predict how many atoms each of these prefixes indicates.

   mono-

   di-

   penta-

Model 2 – Prefixes and Suffixes

Prefix	Numerical Value
mono-	
di-	
tri-	
tetra-	
penta-	
hexa-	
hepta-	
octa-	
nona-	
deca-	

Molecular Formula	Name of Compound
BCl_3	Boron trichloride
SF_6	Sulfur hexafluoride
IF_7	Iodine heptafluoride
NI_3	Nitrogen triiodide
N_2O_4	Dinitrogen tetroxide
Cl_2O	Dichlorine monoxide
P_4O_{10}	Tetraphosphorus decoxide
B_5H_9	Pentaboron nonahydride
Br_3O_8	Tribromine octoxide
ClF	Chlorine monofluoride

5. Examine the prefixes in Model 2. Fill in the numerical value that corresponds to each prefix.
6. What suffix (ending) do all the compound names in Model 2 have in common?
7. Carefully examine the names of the compounds in Model 2. When is a prefix NOT used in front of the name of an element?
8. Consider the compound NO.
   a. Which element, nitrogen or oxygen, would require a prefix in the name? Explain your answer.

   b. Name the molecule NO.
9. Find two compounds in Model 2 that contain a subscript of "4" in their molecular formula.
   a. List the formulas and names for the two compounds.

   b. What is different about the spelling of the prefix meaning "four" in these two names?
10. Find two compounds in Model 2 that contain the prefix "mono-" in their names.
    a. List the formulas and names for the two compounds.

    b. What is different about the spelling of the prefix meaning "one" in these two names?

11. Name each of the following molecular compounds.

Molecular Formula	**Molecule Name**
PBr_3	
SCl_4	
N_2F_2	
SO_3	
BrF	

12. Write molecular formulas for the following compounds.

Molecular Formula	**Molecule Name**
	Disulfur decafluoride
	Carbon tetrachloride
	Oxygen difluoride
	Dinitrogen trioxide
	Tetraphosphorus heptasulfide

13. Use complete sentences to explain why $AlCl_3$ is called "aluminum chloride" (no prefix required), but BCl_3 is called "boron trichloride."

14. In the table below, first identify the type of bonding present in each compound. Then fill in the missing name or formula for each compound using the appropriate set of rules.

Chemical Formula	**Type of Compound/Bonding**	**Compound Name**
CS_2		
PbI_2		
$BaCl_2$		
Se_2S_6		
		Xenon tetrafluoride
		Sodium phosphide
		Dinitrogen pentoxide
		Cobalt(III) bromide