

Naming of Chemical Compounds

Name: _____

NM												NM = nonmetal										
+1	+2											md = metalloid										
+1	+2											+3	NM	NM	NM	NM	NM	NM				
+1	+2										+2		md	md	NM	NM	NM					
+1	+2								+1					md	md	NM	NM					
+1	+2																			md	NM	
+1	+2																					

Type I Binary Ionic Compounds

Type I binary ionic compounds contain a metal and a nonmetal AND the metal that is present only forms one type of cation. **Metals with only one cation (shaded above with positive charges)**. Both the metal and the nonmetal form ions, which is why it is called an **ionic compound**.

- 1) From the following list, cross out those compounds that do NOT belong in the category for Type I binary ionic compounds.

NaCl FeCl₂ CaCl₂ TiO₂ MgO AlBr₃ KCl K₂S BeF₂ Cu₂O₃ AgCl Zn₃N₂

Formula and name examples for Type I binary ionic compounds:

KI = Potassium iodide BaO = Barium oxide ZnF₂ = Zinc fluoride Na₂S = Sodium sulfide
 Ag₃N = Silver nitride BeCl₂ = Beryllium chloride

- What type of element is always listed first (metal or nonmetal)? _____ second? _____
- Is the name of the first element in the compound different from the second element? (yes/no)
- What is the **common ending** for all the names of the **second** elements? _____
- In zinc fluoride, there are 2 Fluorine atoms. Is the number **2** indicated in the name? (yes/no)
- What is the charge on the zinc ion? _____
- What is the charge on the fluoride ion? _____
- What number do these two charges add up to equal? _____
- Why do you need one zinc ion and two fluoride ions for the formula for Zinc fluoride?
- Why do you need two sodium ions for every sulfide ion in Sodium sulfide?
- As a team, determine the rules for **naming** type I binary ionic compound when given the formula.
- As a team, determine the rules for writing the **formula** for a type I binary compound when given the name.

Type II Binary Ionic Compounds

Type II binary ionic compounds also contain a metal and a nonmetal **however** the metal that is present here can form **more than one type of cation**. Metals with multiple possible charges are listed in the periodic table as **blank**. Again, both the metal and the nonmetal form **ions**, and it is still called an **ionic** compound. These metals usually only form two different ions but some can form more than two.

- 1) From the following list, cross out those compounds that do **NOT** belong in the category for **Type II binary ionic compounds**.

AlP FeCl₂ Ag₂O VBr₅ CoS SnF₂ K₃N SrF₂ CuBr AuCl₃ ZnO HgS

Formula and name examples for Type II binary ionic compounds:

Fe₂O₃ = Iron (III) oxide

FeO = Iron (II) oxide

CuS = Copper (II) sulfide

CuCl = Copper (I) chloride

MnO₂ = Manganese (IV) oxide

MnCl₂ = Manganese (II) chloride

- 2) What type of element is always listed first (metal or nonmetal)? _____ second? _____
- 3) Is the name of the first element in the compound different from the second element? (yes/no)
- 4) What is the common ending for the **nonmetal** portion of the names? _____
- 5) In the compound FeO, what is the charge on iron? _____
- 6) In the compound Fe₂O₃, what is the charge on iron? _____
- 7) What does the Roman numeral after the metal name represent? _____
- 8) As a team, determine the rules for **naming** type II binary ionic compound when given the formula.
- 9) As a team, determine the rules for writing the **formula** for a type II binary compound when given the name.

Type III Binary Compounds

Binary compounds that **DO NOT CONTAIN METALS** have **covalent bonds** instead of **ionic bonds**. A covalent bond is formed by **sharing** one or more pairs of electrons. The pair of electrons is shared by both atoms. For example, in forming H₂, each hydrogen atom contributes one electron to the single bond.

- 1) From the following list, cross out those compounds that do **NOT** belong in the category for binary compounds containing only nonmetals or metalloids.

CCl₄ AlCl₃ CO SeF₆ SiO₂ SrI₂ P₄O₁₀ TiO₂ SeO₃ IrCl ZrO₂ N₂O₅

Formula and name examples for Type III binary ionic compounds:

CO₂ = Carbon dioxide

H₂O = Dihydrogen monoxide

IF₅ = Iodine pentafluoride

BF₃ = Boron trifluoride

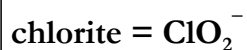
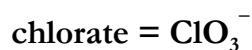
- 2) Which element is listed first in the name?
- 3) Is the name of the first element in the compound different from the second element? (yes/no)
- 4) What is the common ending for all the names of second elements? _____
- 5) What do the prefixes (di-, mono-, penta-, tri-) in the names above mean?
- 6) Is the prefix **mono-** used when there is only one atom of the **first** element? (yes/no)
- 7) Is the prefix **mono-** used when there is one atom of the **second** element? (yes/no)
- 8) As a team, determine the rules for naming type III binary ionic compound when given the formula.

Prefix	Meaning
Mono-	1
Di-	2
Tri-	3
Tetra-	4
Penta-	5
Hexa-	6
Hepta-	7
Octa-	8
Nona-	9
Deca-	10

Compounds Containing Polyatomic Ions

Polyatomic ions are ions that as a group have a set charge. Polyatomic ions are usually recognized in a formula by the **grouping of more than one nonmetal element** after a metal. Your book has a table listing polyatomic ions (Page # on board). Use your book's table to fill in the following table with the appropriate names/formulas of the polyatomic ions.

Name	Formula	Name	Formula
ammonium		chlorate	
nitrate			$C_2H_3O_2^{-1}$
	NO_2^{-1}		CrO_4^{-2}
	OH^{-1}	carbonate	
phosphate			SO_4^{-2}



- 1) When comparing the oxyanions above, is the charge of the chlorate ion the same as the charge for the other chlorine-based polyatomic ions?
- 2) How many **less** oxygen atoms does chlorite have compared to **chlorate**?
- 3) How many **more** oxygen atoms does perchlorate have compared to **chlorate**?
- 4) How many **less** oxygen atoms does hypochlorite have compared to **chlorate**?
- 5) If sulfate is SO_4^{-2} , what would the formula for sulfite be?

In the table below, fill in the name and formula for the remaining polyatomic ions in the columns.

Element	per-___-ate ion	___-ate ion	___-ite ion	hypo-___-ite ion
Bromine (Br)		<i>Bromate</i> BrO_3^-		
Iodine (I)		<i>Iodate</i> IO_3^-		
Phosphorus (P)		<i>Phosphate</i> PO_4^{-3}		
Nitrogen (N)		<i>Nitrate</i> NO_3^-		

Use your knowledge of Type I and Type II metals as well as the polyatomic name/formula to fill in the table.

Name	Formula	Name	Formula
sodium carbonate			$\text{Cu}(\text{NO}_2)_2$
iron(II) nitrate		calcium sulfate	
	MnSO_4	ammonium nitrate	
	$\text{Ca}(\text{ClO})_2$		KCN

WAYS TO MAKE SURE YOU ARE DOING IT CORRECTLY!!!

- Remember when you have parentheses, you must identify the polyatomic ions by looking inside the parentheses and the numbers outside the parentheses indicate how many of that polyatomic ion you have.
- Are the compound formulas you filled into the table above neutral in **overall charge**?
- Do all type II metals in the table above have their charge indicated by either a Roman numeral?
- Are all type I metals listed **without** a Roman numeral?

Acids

Acids are **compounds** that when **dissolved in water**, release **hydrogen ions** (H^+). Therefore, acids must contain Hydrogen in their chemical formulas.

Example: What is the name of the acid with NO_2^- as the ion?

Ion name:

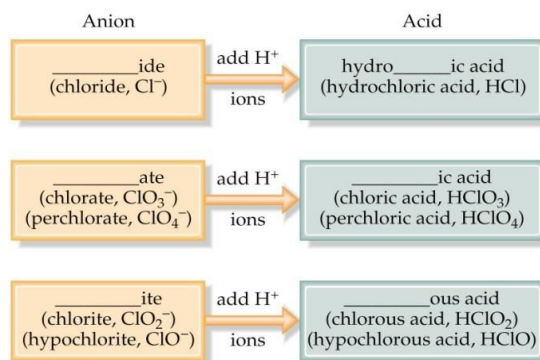
- 1) What is the formula for Nitrate? Is NO_2^- the **nitrate** ion or the **nitrite** ion? _____

Acid formula:

- 2) According to the figure above, what **element** must be added to the beginning of a formula to create an acid? What is the **charge** of the **ion** of that element?
- 3) How many of the **hydrogen ions (+1)** must be added to NO_2^- to make a **neutral acid** (zero charge)?
- 4) What is the **formula** for the acid created when hydrogen ion(s) are added to NO_2^- ?

Acid name:

- 5) Based on your answer to Question 1 above, does the name for the NO_2^- ion end in **-ite** or **-ate**? _____
- 6) Use the figure above to determine the name of the acid, HNO_2 . _____



Fill in the following table:

Acid Formula	Acid Name	Ion Formula	Ion Name
HCl	hydrochloric acid	Cl^-	chloride
		NO_3^-	
	sulfuric acid		
		PO_4^{-3}	
HBr			
	carbonic acid		
		$\text{C}_2\text{H}_3\text{O}_2^-$	