

NM												-3		-2		-1		NM
+1	+2											md	NM	NM	NM	NM	NM	NM
+1	+2											+3	md	NM	NM	NM	NM	NM
+1	+2										+2	md	md	NM	NM	NM		
+1	+2									+1		md	md	NM	NM	NM		
+1	+2														md	NM		
+1	+2																	

NM = nonmetal
md = metalloid

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 below with 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 element? (yes/no)
- What is the common ending for all the names? _____
- In zinc fluoride, there are 2 fluoride atoms, are they indicated in the name? (yes/no)
- What is the charge on the zinc ion? _____
- What is the charge on the fluoride ion? _____
- 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.

- 12) Name each of the type I binary ionic compounds listed in question 1.

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. Type II metals are NOT Type I metals. 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.

- 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 or ferric oxide

FeO = iron(II) oxide or ferrous oxide

CuS = copper(II) sulfide or cupric sulfide

CuCl = copper(I) chloride or cuprous chloride

MnO₂ = manganese(IV) oxide or manganic oxide

MnCl₂ = manganese(II) chloride or manganous 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 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 number after the metal name represent?
8) When the metal name ends in -ic, to what ion does it refer? (higher charge/lower charge)
9) When the metal name ends in -ous, to what ion does it refer? (higher charge/lower charge)
10) As a team, determine the rules for naming type II binary ionic compound when given the formula.
- 11) As a team, determine the rules for writing the formula for a type II binary compound when given the name.
- 12) Name each of the type II binary ionic compounds listed in Question 1 of Type II section.

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

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

- 2) Which element is listed first in the name?
 3) Is the name of the first element in the compound different from the element? (yes/no)
 4) What is the common ending for all the names? _____
 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) Is the prefix mono- used when there is one atom of the second element? (yes/no)
 7) As a team, determine the rules for naming type III binary ionic compound when given the formula.
 8) Name each of the type III binary compounds listed above.

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 elements after a metal. Your book has a table listing polyatomic ions. 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		chlorite	
nitrate			C ₂ H ₃ O ₂ ⁻¹
	NO ₂ ⁻¹		CrO ₄ ⁻²
	OH ⁻¹	carbonate	
cyanide			SO ₃ ⁻²

- 13) In the table below, fill in the name and formula for the oxyanions in the shaded column. Use the figures on the previous page
- 14) In the table below, fill in the name and formula for the rest of the oxyanions.

Element	per-___-ate ion	___-ate ion	___-ite ion	hypo-___-ite ion
Bromine (Br)				
Iodine (I)				
Phosphorus (P)				
Nitrogen (N)				

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

Check your work:

Were the polyatomic ions correctly identified for the above table? *Remember when you have parentheses, you must identify the polyatomic ions by looking inside the parentheses and the numbers outside the parentheses just indicate how many of that polyatomic ion you have.*

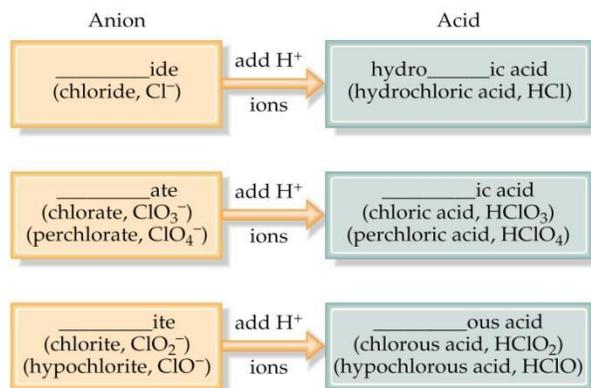
Are the compound formulas you filled into the table above neutral in charge?

Do all type II metals in the table above have their charge indicated by either a Roman numeral or their Latin name with an -ous or -ic ending?

Are all type I metals listed without a Roman numeral?

Acids

Acids are compounds that when dissolved in water, produce hydrogen ions (H^+). Naming acids can also be tricky. Use the following chart and try to classify each acid below to an area on the chart.



Given that the ion formula is NO_2^{-1} , how can one determine the name of the ion, acid formula, and acid name?

Ion name:

- 1) Based on the –ate determination figures, what is the formula for nitrate? Is NO_2^{-1} the nitrate ion or the nitrite ion?

Acid formula:

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

Acid name:

- 5) Based on your answer to Question 1 above, does the name for the NO_2^{-1} ion end in –ite or –ate?
- 6) Use the figure above to determine how the name changes when we have the compound HNO_2 . Name 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		
$HBrO_3$			
		PO_4^{-3}	
HBr			
	carbonic acid		
		$C_2H_3O_2^-$	