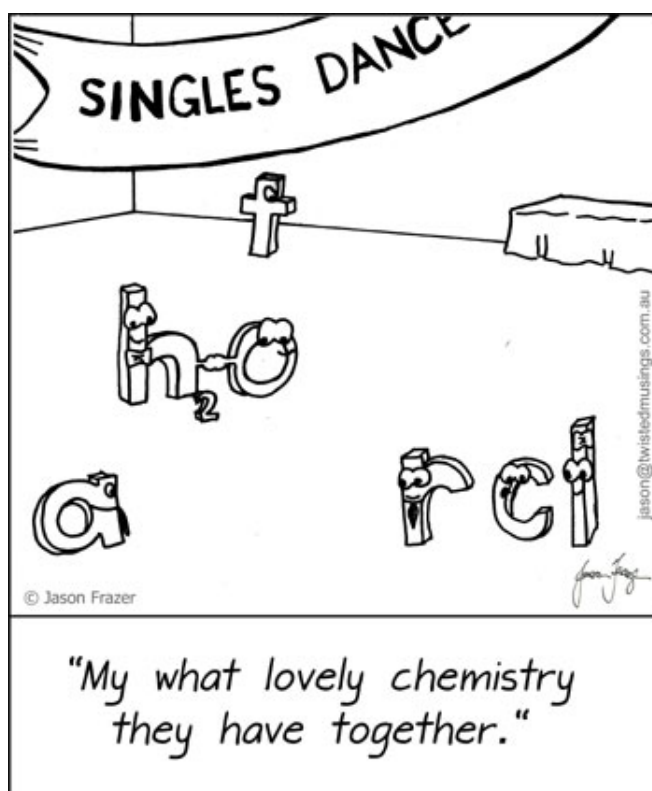


# Science 9

## Unit 2: Chemistry



### BOOK 7: Naming & Writing Chemical Formulas

name: \_\_\_\_\_

block: \_\_\_\_\_

# PERIODIC TABLE OF THE ELEMENTS

NON-METALS																		METALS																	
←																		→																	
18																		1																	
0																		-																	
2																		1																	
He																		H																	
Helium																		Hydrogen																	
4.0																		1.0																	
17																		16																	
9																		8																	
2-																		3-																	
F																		O																	
Fluorine																		Oxygen																	
19.0																		16.0																	
16																		15																	
7																		6																	
3-																		2-																	
N																		C																	
Nitrogen																		Carbon																	
14.0																		12.0																	
15																		14																	
3-																		3+																	
P																		Si																	
Phosphorus																		Silicon																	
31.0																		28.1																	
17																		16																	
2-																		2-																	
Cl																		S																	
Chlorine																		Sulfur																	
35.5																		32.1																	
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0																		-																	
Ar																		Kr																	
Argon																		Krypton																	
39.9																		83.8																	
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Selenium																		Arsenic																	
79.0																		74.9																	
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52																		51																	
2-																		3+																	
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127.6																		121.8																	
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0																		-																	
He																		H																	
Helium																		Hydrogen																	
4.0																		1.0																	

Atomic Number → 22  
 Symbol → Ti  
 Name → Titanium  
 Atomic Mass → 47.9

Ion charge(s) → 4+  
 → 3+

Based on mass of C-12 at 12.00.

Any value in parentheses is the mass of the most stable or best known isotope for elements which do not occur naturally.

## NAMES, FORMULAE AND CHARGES OF SOME POLYATOMIC IONS

Positive Ions	Negative Ions
$\text{NH}_4^+$ Ammonium	$\text{CH}_3\text{COO}^-$ Acetate
	$\text{CO}_3^{2-}$ Carbonate
	$\text{ClO}_3^-$ Chlorate
	$\text{ClO}_2^-$ Chlorite
	$\text{CrO}_4^{2-}$ Chromate
	$\text{CN}^-$ Cyanide
	$\text{Cr}_2\text{O}_7^{2-}$ Dichromate
	$\text{HCO}_3^-$ Hydrogen carbonate, bicarbonate
	$\text{HSO}_4^-$ Hydrogen sulfate, bisulfate
	$\text{HS}^-$ Hydrogen sulfide, bisulfide
	$\text{HSO}_3^-$ Hydrogen sulfite, bisulfite
	$\text{OH}^-$ Hydroxide
	$\text{ClO}^-$ Hypochlorite
	$\text{NO}_3^-$ Nitrate
	$\text{NO}_2^-$ Nitrite
	$\text{ClO}_4^-$ Perchlorate
	$\text{MnO}_4^-$ Permanganate
	$\text{PO}_4^{3-}$ Phosphate
	$\text{PO}_3^{3-}$ Phosphite
	$\text{SO}_4^{2-}$ Sulfate
	$\text{SO}_3^{2-}$ Sulfite

## NAMES AND FORMULAE OF COMMON ACIDS

Hydrochloric acid	$\text{HCl}$
Sulfuric acid	$\text{H}_2\text{SO}_4$
Nitric acid	$\text{HNO}_3$
Acetic acid	$\text{HCH}_3\text{COO}$

## PREFIXES

1	mono
2	di
3	tri
4	tetra
5	penta
6	hexa
7	hepta
8	octa
9	nona
10	deca

## PART A: NAMES AND FORMULAS OF COVALENT COMPOUNDS

A binary covalent compound contains \_\_\_\_\_ elements joined together by one or more covalent bonds.

Unlike ionic compounds, they combine chemically by \_\_\_\_\_ electrons in a covalent bond.

In a covalent compound, the precise number of \_\_\_\_\_ of each element in the molecule is shown by the chemical \_\_\_\_\_.

For example,  $H_2O_2$  is a covalent compound that may be familiar to you as a disinfectant.

Its name is \_\_\_\_\_.

Each molecule of hydrogen peroxide has \_\_\_\_\_ hydrogen atoms and \_\_\_\_\_ oxygen atoms, for a total of four atoms in each molecule

Notice that the formula is **not reduced to HO**, as would be the case for an *ionic compound* where the formula is simplified into the lowest ratio.

In a covalent compound, the \_\_\_\_\_ show the **actual number** of atoms of each element in the molecule.



In chemistry, we must have a set of naming rules to distinguish compounds and make sure the same language is spoken. Different compounds have different formulas, names, and c\_\_\_\_\_.

**So in formula of covalent compounds, the subscripts are VERY IMPORTANT!**

Consider that hydrogen peroxide again, and compare it to water. What are the chemical formula of each:

They differ in \_\_\_\_\_ oxygen, yet their chemical characteristics are vastly different.

Water is vital to our survival and hydrogen peroxide is poisonous if consumed.

### **Naming Covalent Compounds**

**Prefixes** \_\_\_\_\_, indicate the

number of atoms of each element that appear in the formula:

mono	di	tri	tetra	penta	hexa	hepta	octa	nona	deca

**Table 4.13** Prefixes Used in Naming Binary Covalent Compounds

Prefix	Number
mono-	1
di-	2
tri-	3
tetra-	4
penta-	5
hexa-	6
hepta-	7
octa-	8
nona-	9
deca-	10



In  $c$  \_\_\_\_\_  $c$  \_\_\_\_\_, two \_\_\_\_\_ atoms may \_\_\_\_\_ electrons and combine in several ratios.

Therefore, the **name** of the *molecular compound* must **reveal its formula** to distinguish it from the other compounds of the same two elements.

The name of a molecular compound uses a \_\_\_\_\_ to provide its formula.

**The prefixes used are shown >78F.**

The names of all binary compounds have an \_\_\_\_\_ suffix.

\_\_\_\_\_ is therefore \_\_\_\_\_ nitrogen \_\_\_\_\_ oxide.

Note that the \_\_\_\_\_ comes **before the name** of the element but after the symbol of the element.

The prefix **mono-** is assumed for the first element named if no prefix is stated.

For example, carbon \_\_\_\_\_ oxide is \_\_\_\_\_, NOT *monocarbon dioxide*

## 1. FROM CHEMICAL FORMULA --> COMPOUND NAME

### Sample Problem — Determining the NAME of a Molecular Compound from Its Formula

What is the name of  $P_4S_{10}$ ?

#### What to Think about

- Write the names of each element and the number of atoms of each.
- Rewrite this information using the prefix code.

#### How to Do It



Name the following covalent compounds:

- |                  |                      |
|------------------|----------------------|
| 1. $N_2O$ _____  | 6. $N_2O_4$ _____    |
| 2. $CO_2$ _____  | 7. $P_4S_{10}$ _____ |
| 3. $PI_3$ _____  | 8. $S_2F_{10}$ _____ |
| 4. $PCl_5$ _____ | 9. $NI_3$ _____      |
| 5. $SO_2$ _____  | 10. $NO$ _____       |

## 2. FROM COMPOUND NAME --> CHEMICAL FORMULA

1. Confirm that you are dealing with a covalent compound.
2. Translate the prefixes and element names into symbols and subscripts.

### Sample Problem — Determining the FORMULA of a Molecular Compound from Its Name

What is the formula of xenon tetrafluoride?

#### What to Think about

1. Write the symbols of each element and the number of atoms of each.
2. Rewrite this information as a formula.

#### How to Do It



Write the chemical formula for the following covalent compounds:

- |                            |       |                            |       |
|----------------------------|-------|----------------------------|-------|
| 1. nitrogen tribromide     | _____ | 6. sulfur trioxide         | _____ |
| 2. sulfur hexafluoride     | _____ | 7. phosphorus pentabromide | _____ |
| 3. dinitrogen tetrasulfide | _____ | 8. diiodine hexachloride   | _____ |
| 4. oxygen difluoride       | _____ | 9. dichlorine monoxide     | _____ |
| 5. carbon tetraiodide      | _____ | 10. xenon hexafluoride     | _____ |



### Determining the Names and Formulas of Molecular Compounds

1. Write the formula of each of the following molecular compounds:

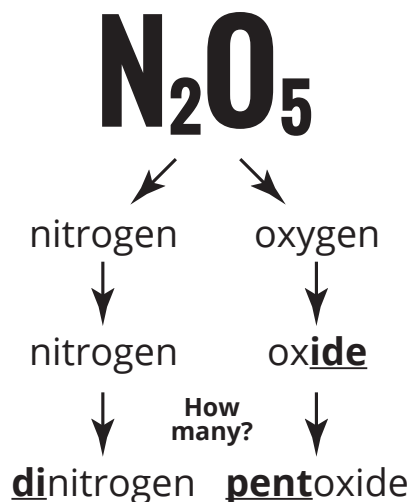
(a) nitrogen monoxide	(c) dinitrogen tetroxide
(b) nitrogen dioxide	(d) dinitrogen trioxide
2. Name each of the following molecular compounds:

(a) $\text{PCl}_5$ _____	(c) $\text{CO}$ _____
(b) $\text{SO}_2$ _____	(d) $\text{P}_2\text{O}_5$ _____

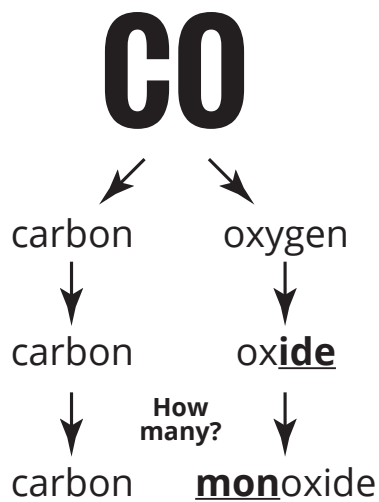
# Writing Compound Names

## Covalent Bonds

(a bond between two nonmetals)



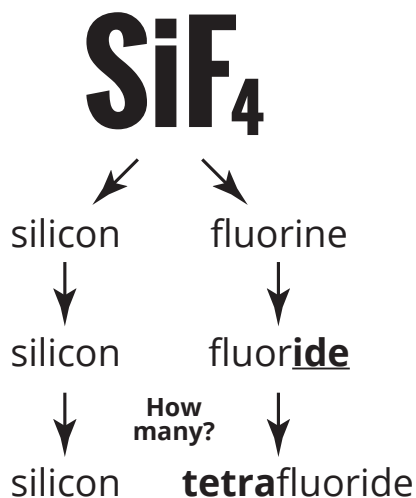
**dinitrogen pentoxide**



**carbon monoxide**

prefix	number
<i>mono-</i>	1
<i>di-</i>	2
<i>tri-</i>	3
<i>tetra-</i>	4
<i>penta-</i>	5
<i>hexa-</i>	6
<i>septa-</i>	7
<i>octa-</i>	8
<i>nona-</i>	9
<i>deca-</i>	10

Notice that we don't use the prefix *mono-* here. That's because it's the first element in the compound.



**silicon tetrafluoride**

If the element starts with a vowel, you may need to drop the *o-* or *a-* at the end of your prefix.

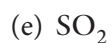
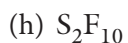
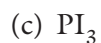
*penta-* → **pentoxide**  
*di-* → **dioxide**  
*tetra-* → **tetroxide**  
*hexa-* → **hexoxide**



**Assignment #1: Covalent Compounds Practice Problems**  
*Complete this assignment in the space provided below.*

**Practice Problems**

1. Write the names of the following compounds.



2. Write the formulas of the following compounds.

(a) nitrogen tribromide

(f) sulfur trioxide

(b) sulfur hexafluoride

(g) phosphorus pentabromide

(c) dinitrogen tetrasulfide

(h) diiodine hexachloride

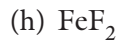
(d) oxygen difluoride

(i) dichlorine monoxide

(e) carbon tetraiodide

(j) xenon hexafluoride

3. Identify each of the following compounds as either ionic or covalent.





## PART B: NAMING & FORMULA OF IONIC COMPOUNDS

- Ionic compounds are ALWAYS made up of a \_\_\_\_\_ and a \_\_\_\_\_ (and are always written in that order).
- Recall the first ionic compound example we did: **sodium and chlorine**.
  - \_\_\_\_\_ donated an electron to \_\_\_\_\_ so that they both had full \_\_\_\_\_.
  - The  $\text{Na}^+$  and  $\text{Cl}^-$  ions are attracted to each other forming an \_\_\_\_\_ bond.
  - To name the new compound formed, the \_\_\_\_\_ ions keep their name: (both Na and  $\text{Na}^+$  are called sodium).
  - \_\_\_\_\_ ions' endings change to **IDE** (Cl is called chlorine and  $\text{Cl}^-$  is called chloride).
  - So, the compound is called \_\_\_\_\_.

*What makes up an ionic compound?*

*What is happening with the electrons of the atoms involved?*

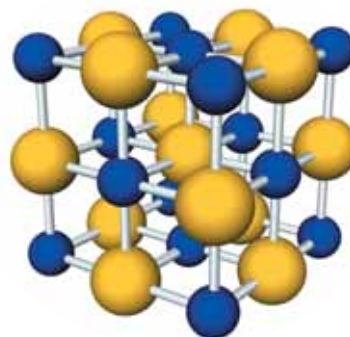


Figure 4.19 The arrangement of ions in sodium chloride



### 1. FROM CHEMICAL FORMULA --> COMPOUND NAME

#### Ions of Non-metals

Step 1:

Step 2:

Element	Ion	Symbol
fluorine		
chlorine		
bromine		
iodine		
oxygen		
sulfur		
selenium		
nitrogen		
phosphorus		

**Example:** Name the compound formed:

**Potassium + Chlorine**

The first part of names the \_\_\_\_\_ ion, \_\_\_\_\_

The positive ion is always a \_\_\_\_\_ in a compound containing two elements.

*The positive, metal ion is **always written first.***

The second part is the \_\_\_\_\_ ion, **chloride** an ion of \_\_\_\_\_.

The negative ion is always a \_\_\_\_\_ in a compound containing two elements.

The non-metals name always ends with " \_\_\_\_\_ "

*The negative, non-metal ion is **always written second.***

**Example:** Name the compound:

**CaO**



Name the following:

- Calcium + fluorine \_\_\_\_\_
- Aluminum + sulfur \_\_\_\_\_
- Potassium + oxygen \_\_\_\_\_
- Lithium + chlorine \_\_\_\_\_
- $ZnI_2$  \_\_\_\_\_
- $Na_3N$  \_\_\_\_\_
- $MgS$  \_\_\_\_\_
- $BaCl_2$  \_\_\_\_\_
- $Ba_3P_2$  \_\_\_\_\_

**carbon**  
**oxygen**  
**nitrogen**  
**sulphur**  
**iodine**  
**bromine**  
**chlorine**  
**fluorine**



## ASSIGNMENT #2: Ionic Compounds Naming

*This assignment is to be completed below in the space provided.*

**Name the following ionic compounds.**

1. Potassium + iodine

---

2. Sodium + oxygen

---

3. Potassium + bromine

---

4. Zinc + sulfur

---

5. Silver + oxygen

---

6. Aluminum + iodine

---

7. Lithium + bromine

---

8. Potassium + sulfur

---

9.  $\text{BaF}_2$

---

10.  $\text{Al}_2\text{O}_3$

---

11.  $\text{NaF}$

---

12.  $\text{MgF}_2$

---

13.  $\text{BeS}$

---

14.  $\text{K}_2\text{O}$

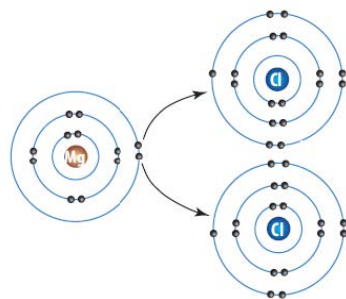
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15.  $\text{MgI}_2$

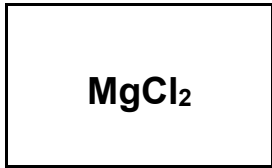
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## Formula Writing - Ionic Compounds



What is a chemical formula?



## Charge Balancing Method of Formula Writing

**EXAMPLE:**

**Aluminum chloride**

Step 1:

Step 2:



**Sodium sulfide**

Step 1:

Step 2:

## Swap & Drop (criss cross) Method of Formula Writing

EXAMPLE:

Aluminum oxide

Step 1:

Step 2:



Calcium nitride

Step 1:

Step 2:



Things to watch out for with the criss cross method:

Example:

Calcium oxide



1. Write the formulas of the ionic compounds containing the following ions:

a.  $\text{Na}^+$  and  $\text{Br}^-$  \_\_\_\_\_

b.  $\text{K}^+$  and  $\text{S}^{2-}$  \_\_\_\_\_

c.  $\text{Zn}^{2+}$  and  $\text{I}^-$  \_\_\_\_\_

d.  $\text{Mg}^{2+}$  and  $\text{N}^{3-}$  \_\_\_\_\_

**ASSIGNMENT #3: Ionic Compounds Naming & Formula Review pg 12-13**

*This assignment is to be completed below in the space provided.*

<b>Combine the following:</b>	<b>Ions are:</b>	<b>Chemical Formula is:</b>	<b>Chemical Name is:</b>	<b>Total number of atoms is:</b>
<b>Calcium + chlorine</b>	<b>Ca<sup>2+</sup> Cl<sup>-</sup></b>	<b>CaCl<sub>2</sub></b>	<b>calcium chloride</b>	<b>1 Ca + 2 Cl = 3</b>
Hydrogen + iodine				
Magnesium + sulfur				
Aluminum + oxygen				
Lithium + fluorine				
Sodium + bromine				
Barium + nitrogen				
Beryllium + chlorine				
Zinc + oxygen				
Magnesium + iodine				



## Review of Naming & Formulae

Compound	Name of Ionic Compound OR Ionic Formula
1. $\text{CaI}_2$	
2. $\text{Na}_3\text{P}$	
3. $\text{Ag}_2\text{O}$	
4. $\text{RbF}$	
5. $\text{MgBr}_2$	
6. $\text{AgI}$	
7. $\text{AlBr}_3$	
8. zinc oxide	
9. barium iodide	
10. sodium sulfide	
11. zirconium fluoride	
12. zinc phosphide	
13. gallium iodide	
14. silver nitride	
15. rubidium selenide	

## PART C: NAMING & FORMULA OF MULTIVALENT IONIC COMPOUNDS

Have a look at your periodic table, can you find any elements that have more than one ion charge? List an example below:

**Multivalent metals** are metals that can form more than one type of \_\_\_\_\_. For example, \_\_\_\_\_ can form an ion with a \_\_\_\_\_ or a \_\_\_\_\_ charge.

That means that copper can give up either \_\_\_\_\_ or \_\_\_\_\_ electrons when forming an \_\_\_\_\_.

### 1. FROM COMPOUND NAME --> CHEMICAL FORMULA

When we name multivalent metals we need a way of distinguishing what ion charge of the multivalent metals is involved.

For this we use \_\_\_\_\_.

- $\text{Ni}^{2+}$  or \_\_\_\_\_ called “nickel two” and shows the nickel ion has an ion charge of 2+.
- $\text{Ni}^{3+}$  or \_\_\_\_\_ is called “nickel three” and shows the nickel ion has an ion charge of 3+.

**Table 4.7**  
Roman Numerals

Metal Ion Charge	Roman Numeral
1+	I
2+	II
3+	III
4+	IV
5+	V
6+	VI
7+	VII

For example, the name chromium (III) chloride tells you that that chromium ion in the compound is \_\_\_\_\_ not \_\_\_\_\_.

When we write the chemical formula for an ionic compound containing a multivalent metal, the same steps we have already learned still apply.

You can use the charge balancing method or the criss cross method.

The only thing that is new is that we will see a \_\_\_\_\_ in the name of the compound telling us which \_\_\_\_\_ is involved.



## Writing Formulas of Compounds Containing a Multivalent Metal

Steps	Examples	
	manganese(IV) sulfide	cobalt(III) oxide
1. Identify each ion and its charge.		
2. Determine the total charges needed to balance positive with negative.		
3. Note the ratio of positive ions to negative ions.		
4. Use subscripts to write the formula. A "1" is not shown in the subscripts.		



(a) copper(I) nitride

(b) iron(II) phosphide

(c) chromium (III) chloride



**ASSIGNMENT #4: Writing formulas of Ionic Compounds with MULTIVALENT ions**

*This assignment is to be completed below in the space provided.*

**Practice Problems**

1. Write the formulas of the following compounds containing multivalent metals.

(a) manganese(II) oxide \_\_\_\_\_

(b) manganese(IV) oxide \_\_\_\_\_

(c) chromium(II) bromide \_\_\_\_\_

(d) chromium(III) bromide \_\_\_\_\_

(e) lead(IV) chloride \_\_\_\_\_

(f) iron(III) phosphide \_\_\_\_\_

(g) tin(II) sulfide \_\_\_\_\_

(h) tin(II) nitride \_\_\_\_\_

(i) mercury(II) fluoride \_\_\_\_\_

(j) tin(IV) nitride \_\_\_\_\_

(k) copper(I) iodide \_\_\_\_\_

(l) copper(II) iodide \_\_\_\_\_

(m) Iron (II) iodide \_\_\_\_\_

(n) Nickel (III) sulfide \_\_\_\_\_

(o) Iron (II) fluoride \_\_\_\_\_

(p) Copper (II) chloride \_\_\_\_\_

(q) Tin (IV) oxide \_\_\_\_\_

(r) Titanium (IV) oxide \_\_\_\_\_

## 2. FROM CHEMICAL FORMULA --> COMPOUND NAME

### Naming an Ionic Compound with a Multivalent Metal

The compound  $\text{Fe}_2\text{O}_3$  is the main source of iron in the making of steel, which is used for things like cutlery to shipping freighters.

Pure  $\text{Fe}_2\text{O}_3$  is reddish in colour and is used as a pigment in some paints.

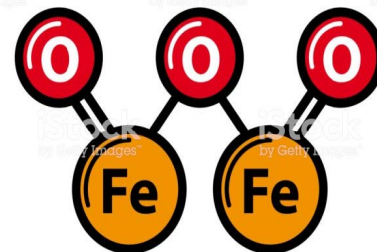


What is the name of  $\text{Fe}_2\text{O}_3$ ?

**Step 1:** Identify the ions.

**Step 2:**

Work backwards using either charge balancing or criss cross methods to determine which iron ion is involved in the compound.



**Step 3:**

Write the name of the compound using a \_\_\_\_\_ to indicate the charge of the multivalent metal ion.

Don't forget you still need to name the non-metal with a \_\_\_\_\_ ending!

## NAMING Ionic Compounds that Contain a Multivalent Metals: (reverse "swap and drop")

### Naming Ionic Compounds Containing a Multivalent Metal

Steps	Examples	
	Au <sub>3</sub> N	PdS <sub>2</sub>
1. Identify the metal.		
2. Verify that it can form more than one kind of ion by checking the periodic table.		
3. Determine the ratio of the ions in the formula.		
4. Note the charge of the negative ion from the periodic table.		
5. The positive and negative charges must balance out. Determine what the charge needs to be on the metal ion to balance the negative ion.		
6. Write the name of the compound.		



Each of these compounds contains a multivalent metal ion. That means that the name of the metal ion will contain a Roman numeral, which you will need to determine. Write the names of the following compounds.





## ASSIGNMENT #5: Naming Ionic Compounds with MULTIVALENT ions

This assignment is to be completed below in the space provided.

**Example:** Write the names of the following:

- $\text{FeCl}_3$  ( $\text{Fe}^{3+}$ ) iron (\_\_\_\_) chloride
- $\text{CuCl}$  ( $\text{Cu}^+$ ) copper (\_\_\_\_) chloride
- $\text{SnF}_4$  ( $\text{Sn}^{4+}$ ) tin (\_\_\_\_) fluoride
- $\text{PbCl}_2$  ( $\text{Pb}^{2+}$ ) lead (\_\_\_\_) chloride
- $\text{Fe}_2\text{S}_3$  ( $\text{Fe}^{3+}$ ) iron (\_\_\_\_) sulfide

1. Write the **names** of the compounds with the following ions:

- $\text{Co}^{3+}$  and  $\text{O}^{2-}$  \_\_\_\_\_
- $\text{Cu}^+$  and  $\text{Br}^-$  \_\_\_\_\_
- $\text{Cu}^{2+}$  and  $\text{Cl}^-$  \_\_\_\_\_
- $\text{Mn}^{4+}$  and  $\text{S}^{2-}$  \_\_\_\_\_

2. Write the **names** of the following compounds. Each contains an ion of a multivalent metal.

- $\text{FeO}$  \_\_\_\_\_
- $\text{Cu}_3\text{N}$  \_\_\_\_\_
- $\text{SnS}_2$  \_\_\_\_\_
- $\text{Sn}_3\text{N}_2$  \_\_\_\_\_
- $\text{Ni}_2\text{S}_3$  \_\_\_\_\_
- $\text{MoCl}_3$  \_\_\_\_\_
- $\text{PbF}_4$  \_\_\_\_\_
- $\text{TiS}_2$  \_\_\_\_\_

3. Write the **chemical formula** for the following compounds.

- lead (IV) chloride \_\_\_\_\_
- lead (II) sulfide \_\_\_\_\_



# Ionic Compound Formation

Circle the word that completes the sentences in the following paragraph: Ions, which are charged particles, can be either positive or negative. Positive ions, known as [ cations / anions ] have [ lost / gained ] electrons and are represented in this activity by cards that have indents. Each indent represents a respective quantity of electrons. Additionally, negative ions, known as [ cations / anions ] have [ lost / gained ] electrons and are represented by cards that have points. The number of points represents a respective quantity of electrons.

Piece together the correct ions in such a way as to make a rectangle, then fill in the corresponding boxes in each row.

Compound name	Built Model	cation : anion ratio	Compound formula
aluminum oxide		2 : 3	Al <sub>2</sub> O <sub>3</sub>
calcium carbonate		___ : ___	
sodium hydroxide		___ : ___	
iron(III) nitrate		___ : ___	
lithium sulfate		___ : ___	

Compound name	Built Model	cation : anion ratio	Compound formula
iron(II) nitrate		___ : ___	
ammonium hydroxide		___ : ___	
potassium phosphate		___ : ___	
calcium chloride		___ : ___	
magnesium acetate		___ : ___	

Compound name	Built Model	cation : anion ratio	Compound formula
copper(III) nitride		___ : ___	
copper(II) oxide		___ : ___	
iron(III) oxide		___ : ___	
sodium oxide		___ : ___	
magnesium hydroxide		___ : ___	

# PART D: NAMING & FORMULA OF POLYATOMIC IONIC COMPOUNDS

## REMEMBER THAT:

A **polyatomic** ion is composed of more than one type of \_\_\_\_\_ joined by \_\_\_\_\_ bonds.


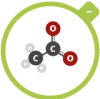





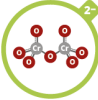




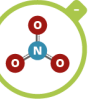
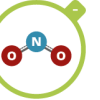







Because polyatomic ions carry an e \_\_\_\_\_ c \_\_\_\_\_, they **cannot** exist on their own.

An example of a polyatomic ion is:

carbonate,  $\text{CO}_3^{-2}$

The figure *right* (and your data booklet) lists some common polyatomic ions.

**You do not have to memorize the names.**

POLYATOMIC IONS: NAMES, FORMULAE & CHARGES						
A polyatomic ion is a charged species consisting of two or more atoms covalently bonded together. Here's a guide to some of the most common examples!						
						
AMMONIUM Formula: $\text{NH}_4^+$	ACETATE Formula: $\text{C}_2\text{H}_3\text{O}_2^-$	CARBONATE Formula: $\text{CO}_3^{2-}$	CHLORATE Formula: $\text{ClO}_3^-$	CHLORITE Formula: $\text{ClO}_2^-$	CHROMATE Formula: $\text{CrO}_4^{2-}$	CYANIDE Formula: $\text{CN}^-$
						
DICHROMATE Formula: $\text{Cr}_2\text{O}_7^{2-}$	HYDROGEN CARBONATE Formula: $\text{HCO}_3^-$	HYDROGEN SULFATE Formula: $\text{HSO}_4^-$	HYDROXIDE Formula: $\text{OH}^-$	HYPOCHLORITE Formula: $\text{ClO}^-$	NITRATE Formula: $\text{NO}_3^-$	NITRITE Formula: $\text{NO}_2^-$
						
PERCHLORATE Formula: $\text{ClO}_4^-$	PERMANGANATE Formula: $\text{MnO}_4^-$	PEROXIDE Formula: $\text{O}_2^{2-}$	PHOSPHATE Formula: $\text{PO}_4^{3-}$	SULFATE Formula: $\text{SO}_4^{2-}$	SULFITE Formula: $\text{SO}_3^{2-}$	THIOSULFATE Formula: $\text{S}_2\text{O}_3^{2-}$
© COMPOUND INTEREST 2016 - WWW.COMPOUNDCHEM.COM   Twitter: @compoundchem   Facebook: www.facebook.com/compoundchem This graphic is shared under a Creative Commons Attribution-NonCommercial-NoDerivatives International 4.0 licence.						



Write the name or formula of the following polyatomic ions:

- $\text{NH}_4^+$  \_\_\_\_\_
- $\text{CrO}_4^{2-}$  \_\_\_\_\_
- Acetate \_\_\_\_\_
- $\text{CN}^-$  \_\_\_\_\_
- $\text{SO}_4^{2-}$  \_\_\_\_\_
- Sulfite \_\_\_\_\_
- Hypochlorite \_\_\_\_\_
- $\text{OH}^-$  \_\_\_\_\_
- Bisulphite \_\_\_\_\_
- $\text{HCO}_3^-$  \_\_\_\_\_

- Polyatomic ions are treated just like other \_\_\_\_\_ but when naming compounds we \_\_\_\_\_ change their \_\_\_\_\_ (they are already ions)
  - Example:  $\text{NO}_3^{-1}$  is \_\_\_\_\_, not nitratide
- You will recognize that there is a polyatomic ion present, because the compound will look like it has more than \_\_\_\_\_. It doesn't! Just split up the compound after the metal, and then find the other ion in your data booklet.
- Remember to use \_\_\_\_\_ in the formula if more than one is present, as you will see from examples.

# 1. FROM CHEMICAL FORMULA --> COMPOUND NAME



Step 1: How do you know you are dealing with a polyatomic ion?

Step 2:

Step 3:



Step 1:

Step 2:

Step 3:



Write the name of the following compounds that contain **polyatomic ions**.

1.  $\text{Li}_3\text{PO}_4$  \_\_\_\_\_

2.  $(\text{NH}_4)_3\text{P}$  \_\_\_\_\_

3.  $\text{Ca}(\text{OH})_2$  \_\_\_\_\_

4.  $\text{Fe}(\text{OH})_3$  \_\_\_\_\_

5.  $\text{Mn}(\text{SO}_4)_2$  \_\_\_\_\_



## 2. FROM COMPOUND NAME --> CHEMICAL FORMULA

### Aluminum chromate

Note that if there is more than one of the polyatomic compounds, you must put it in parenthesis and add subscripts.

Cross the charges circled to balance and neutralize the compound.

Notice the use of brackets in the formula to allow the ratio of ions to be shown correctly. Brackets are dropped if the ion is **not polyatomic** or if the **ratio** number outside the brackets is 1.

When you read the formula, you should always remember that the ratio numbers and brackets are implied.

FOR EXAMPLE:  $\text{Na}_2\text{CO}_3$  as sodium carbonate with 2  $\text{Na}^+$  ions for every 1  $\text{CO}_3^{2-}$  ion.

$\text{Ca}(\text{OH})_2$  as calcium hydroxide with 1  $\text{Ca}^{2+}$  ions for every 2  $\text{OH}^-$  ion.

### Magnesium sulfate



1. Write the formula of each of the following compounds:

- barium nitrate \_\_\_\_\_
- potassium carbonate \_\_\_\_\_
- nickel (II) sulfate \_\_\_\_\_
- magnesium phosphate \_\_\_\_\_
- sodium dichromate \_\_\_\_\_



**ASSIGNMENT #6: Ionic Compounds with POLYATOMIC IONS Naming & Formula Review + MAZE on page 27**

*This assignment is to be completed below in the space provided.*

**Part 1** – Write the name for each of the following ionic compounds.

- |   |                  |                                 |       |
|---|------------------|---------------------------------|-------|
| 1. $\text{Na}_2\text{CO}_3$             | sodium carbonate | 2. $\text{Fe}(\text{OH})_3$     | _____ |
| 3. $\text{KCH}_3\text{COO}$             | _____            | 4. $\text{Co}(\text{ClO})_2$    | _____ |
| 5. $(\text{NH}_4)_3\text{PO}_4$         | _____            | 6. $\text{Mg}_3(\text{PO}_4)_2$ | _____ |
| 7. $\text{Ca}(\text{CH}_3\text{COO})_2$ | _____            | 8. $\text{Mg}_3(\text{PO}_3)_2$ | _____ |
| 9. $(\text{NH}_4)_3\text{P}$            | _____            | 10. $\text{Ni}(\text{HS})_3$    | _____ |
| 11. $(\text{NH}_4)_3\text{PO}_4$        | _____            | 12. $\text{CuCN}$               | _____ |
| 13. $\text{Al}(\text{OH})_3$            | _____            | 14. $\text{Mn}(\text{SO}_3)_2$  | _____ |

**Part 2** – Write the formula for each of the following ionic compounds:

Compound Name	Work	Formula
15. calcium carbonate		$\text{CaCO}_3$
16. manganese (III) chlorate		_____
17. lithium fluoride		_____
18. potassium permanganate		_____
19. sodium chromate		_____
20. ammonium nitrate		_____
21. lithium hydroxide		_____
22. aluminum hydroxide		_____
23. lead (II) perchlorate		_____
24. iron (III) hydrogen sulfide		_____
25. vanadium (V) nitrate		_____
26. chromium (II) nitrite		_____
27. nickel (III) sulfite		_____

# Ionic Compounds Maze

**Directions:** Read the question in the START block. Choose the path to the next question by choosing the correct answer. Color the questions and answers of your path as you move from START to FINISH.

<p><b>START</b></p> <p>What is the chemical formula for Iron (III) chloride?</p>	<p>Fe<sub>3</sub>Cl</p> <p>FeCl<sub>3</sub></p>	<p>What is the name of the compound Na<sub>2</sub>CO<sub>3</sub>?</p>	<p>Sodium carbonate</p> <p>Sodium carbon</p>	<p>What is the chemical formula for the compound Ammonium sulfate?</p>	<p>(NH<sub>4</sub>)<sub>2</sub>S</p> <p>NH<sub>4</sub>S</p>	<p>What is the chemical formula for the compound Aluminum fluoride?</p>	
<p>FeCl</p>	<p>Fe<sub>2</sub>Cl</p>	<p>Sodium trioxide</p>	<p>Sodium carbide</p>	<p>(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub></p>	<p>NH<sub>4</sub>SO<sub>4</sub></p>	<p>AlF</p>	<p>AlF<sub>3</sub></p>
<p>What is the chemical formula for Iron (II) chloride?</p>	<p>CaNO<sub>3</sub></p> <p>Ca(NO<sub>3</sub>)<sub>2</sub></p>	<p>What is the chemical formula for the compound Calcium nitrate?</p>	<p>Copper (II) oxide</p> <p>Copper monoxide</p>	<p>What is the name of the compound CuO?</p>	<p>LiO</p> <p>Li<sub>2</sub>O</p>	<p>What is the chemical formula for the compound Lithium oxide?</p>	
<p>FeCl<sub>2</sub></p>	<p>K<sub>2</sub>OH</p>	<p>Al<sub>3</sub>S<sub>2</sub></p>	<p>Ca(NO<sub>2</sub>)<sub>2</sub></p>	<p>Copper oxide</p>	<p>Lithium chlorite</p>	<p>Li<sub>2</sub>O<sub>2</sub></p>	<p>Li<sub>2</sub>O<sub>1</sub></p>
<p>What is the chemical formula for the compound Potassium hydroxide?</p>	<p>K(OH)<sub>2</sub></p> <p>KOH</p>	<p>What is the chemical formula for the compound Aluminum sulfide?</p>	<p>Al<sub>2</sub>S<sub>3</sub></p> <p>AlS</p>	<p>What is the name of the compound LiCl?</p>	<p>Lithium chloride</p> <p>Lithium (I) chloride</p>	<p><b>FINISH</b></p>	
						<p>27</p>	

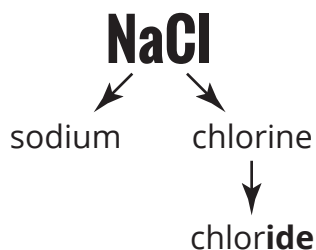
# Writing Compound Names

## Ionic Bonds

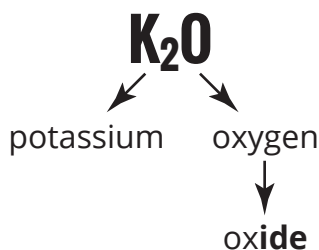
(a bond between a metal and a nonmetal)

### Naming a Binary Ionic Compound

(two elements with no transition metals)



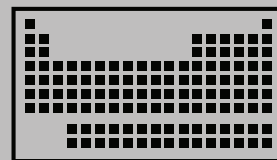
sodium chloride



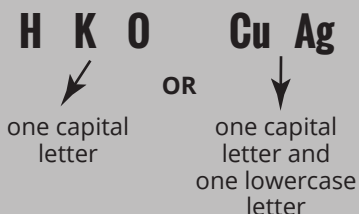
potassium oxide

### Element or Polyatomic Ion?

**Elements** are found on the periodic table.



**Elements** look like this:

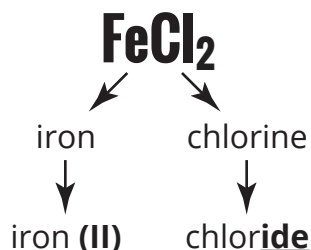


**Polyatomic ions** are groups of two or more elements.

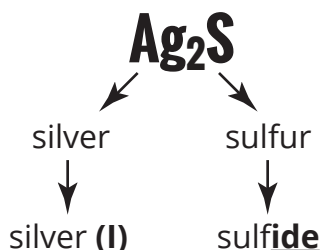


They stick together.

### Naming a Compound with a Transition Metal



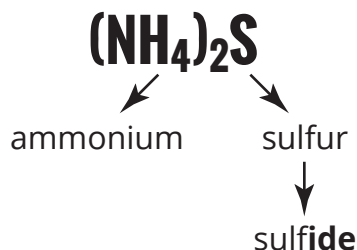
iron (II) chloride



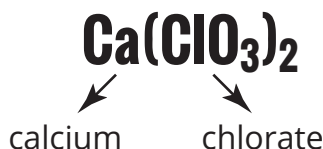
silver (I) sulfide

you can figure out this number based on the number of atoms of the second element

### Naming a Compound with a Polyatomic Ion



ammonium sulfide

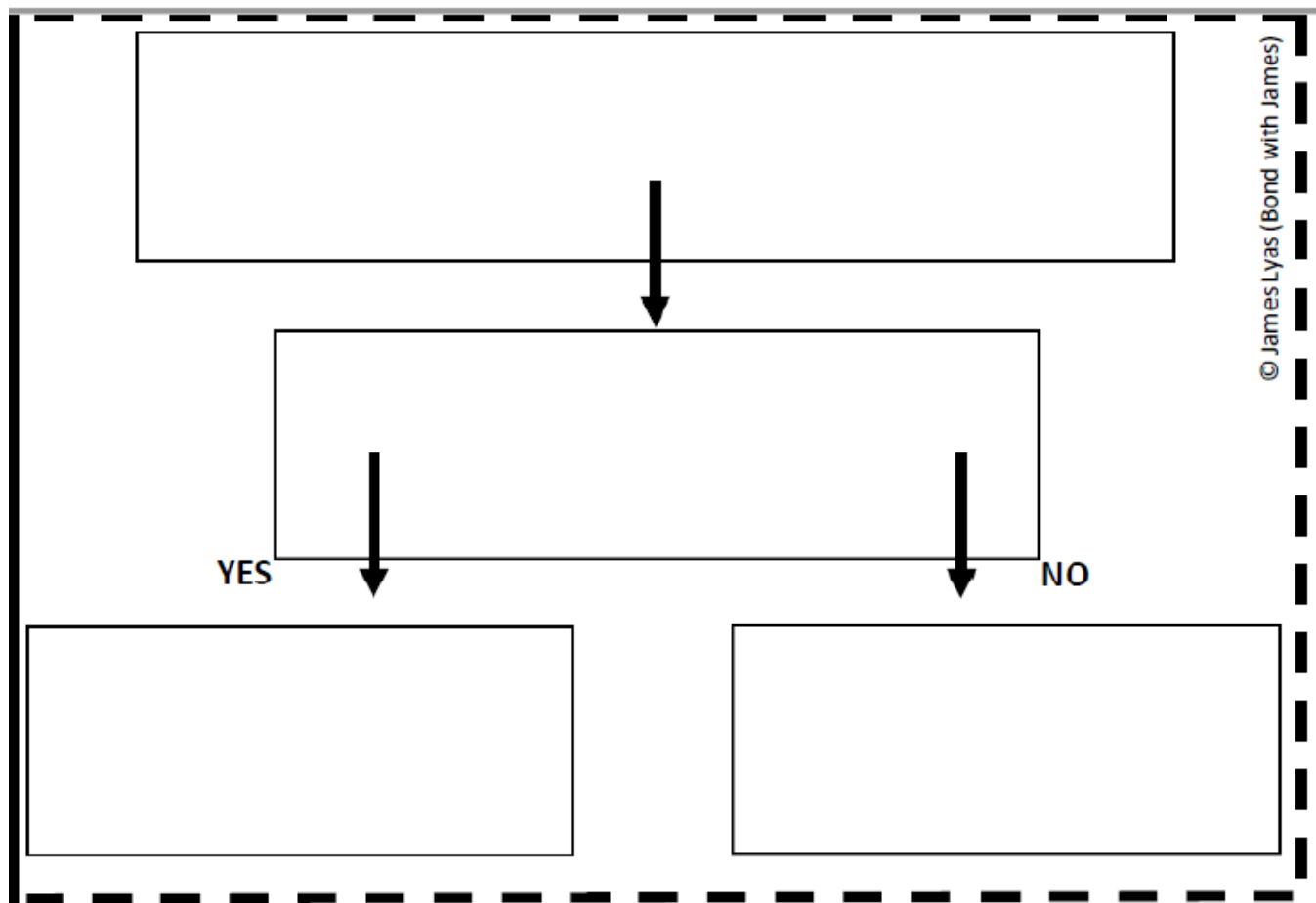


notice that we don't change the ending of polyatomic ions

calcium chlorate

# Steps for Naming Binary Ionic Compounds

Tape/glue behind here



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**Directions:** Cut out the organizer and smaller pieces along the dotted lines only. Then tape or glue the pieces to help construct a logical sequence of steps for naming ionic compounds.

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Write the name of the metallic cation, followed by the name of the non-metallic anion.

Does the metallic cation have more than one oxidation number?

Determine if the compound contains a metal (forms a cation) and a non-metal (forms an anion).

Write the name of the metallic cation, followed by a Roman numeral to represent the charge. Finally write the name of the non-metallic anion.





**REVIEW ASSIGNMENT: Part A + Part B Ionic & Covalent Naming and Formula writing Practice**  
*This assignment is to be completed below in the space provided.*

## Part A) Ionic & Covalent Compound Formula Writing

First, identify whether these compounds are ionic or covalent. Then, use the correct formula writing rules to write the correct chemical formulas for each compound.

	Compound Name	Type of Compound: Ionic or Covalent	Chemical Formula
1)	copper (II) chlorite		
2)	sodium hydroxide		
3)	nitrogen dioxide		
4)	cobalt (III) oxalate		
5)	ammonium sulfide		
6)	aluminum cyanide		
7)	carbon disulfide		
8)	tetraphosphorous pentoxide		
9)	potassium permanganate		
10)	manganese (III) chloride		
	Compound Name	Type of Compound: Ionic or Covalent	Chemical Formula
11)	calcium bromate		
12)	carbon monoxide		
13)	potassium oxide		
14)	antimony tribromide		
15)	zinc phosphate		
16)	copper (II) bicarbonate		
17)	dinitrogen tetroxide		
18)	manganese (IV) carbonate		
19)	lead (IV) nitride		
20)	pentacarbon decahydride		

## Part B) Ionic & Covalent Compound Naming

First, identify whether these compounds are ionic or covalent. Then, use the correct naming rules to write the correct names for each compound.

	Chemical Formula	Type of Compound: Ionic or Covalent	Compound Name
21)	<b>CdBr<sub>2</sub></b>		
22)	<b>Cr(Cr<sub>2</sub>O<sub>7</sub>)<sub>3</sub></b>		
23)	<b>SBr<sub>2</sub></b>		
24)	<b>(NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub></b>		
25)	<b>CuO</b>		
26)	<b>Pt<sub>3</sub>(PO<sub>3</sub>)<sub>4</sub></b>		
27)	<b>Al(ClO<sub>4</sub>)<sub>3</sub></b>		
28)	<b>NH<sub>3</sub></b>		
29)	<b>Ca(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub></b>		
30)	<b>N<sub>2</sub>O</b>		
	Chemical Formula	Type of Compound: Ionic or Covalent	Compound Name
31)	<b>V(SO<sub>4</sub>)<sub>2</sub></b>		
32)	<b>Ag<sub>2</sub>CO<sub>3</sub></b>		
33)	<b>N<sub>2</sub>S<sub>3</sub></b>		
34)	<b>FeSO<sub>3</sub></b>		
35)	<b>Zn(NO<sub>2</sub>)<sub>2</sub></b>		
36)	<b>C<sub>6</sub>H<sub>12</sub>O<sub>6</sub></b>		
37)	<b>PCl<sub>3</sub></b>		
38)	<b>Mn(OH)<sub>7</sub></b>		
39)	<b>Ni(NO<sub>3</sub>)<sub>2</sub></b>		
40)	<b>O<sub>2</sub></b>		