

# Ionic Compounds

## The Language of Chemistry

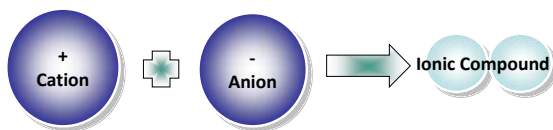
Chemistry has a language all of its own

Chemistry	English
Element Symbols	Letters
Chemical Formulas	Words
Chemical Equations	Sentences

*Each element symbol starts with a capital letter*

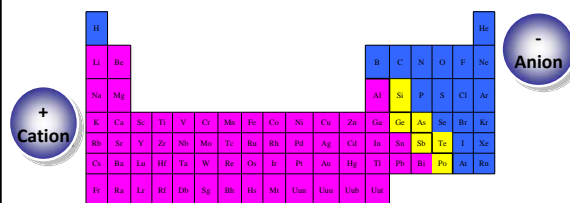
## Ionic Compounds

**Ionic bond:** bond formed by *attraction* between + and - ions



## Metals and Non-Metals

Ionic Bonds occur between metals & non-metals



## Binary Ionic Compounds Name to Formula

### Binary Ionic Name to Formula

- Names will...
  - end in "-ide" (except "hydroxide and cyanide")
- To write formulas:
  - Symbol & charge of the metal cation
  - Symbol & charge of the non-metal anion
  - Add more of the cations and/or anions until you have a neutral compound – 8 valence electrons!
  - Use subscripts to show how many of each type of ion you have

## Example

**Sodium fluoride**

## Let's Practice

Example:  
Write the  
following  
chemical  
formulas

Cesium chloride

Potassium oxide

Calcium sulfide

Lithium nitride

## Let's Practice

Example:  
Write the  
following  
chemical  
formulas

Cesium chloride      CsCl

Potassium oxide      K<sub>2</sub>O

Calcium sulfide      CaS

Lithium nitride      Li<sub>3</sub>N

## Binary Ionic Compounds Formula to Name

## Binary Ionic Formula to Name

- Formula will...
  - Contain only 2 elements
  - Contain a metal cation and a non-metal anion
- To name:

**Metal name + nonmetal name ending in *-ide***

*The subscripts in the formula do not matter when naming this type*

## Example

**CaBr<sub>2</sub>**

## Example



## Let's Practice

Example:  
Write the name  
for the following  
compounds



## Let's Practice

Example:  
Write the name  
for the following  
compounds



## Multivalent Ionic Compounds

## Multivalent (Transition) Metals

**Multivalent Metal:** a metal that has more than one possibility for cationic (positive) charge

The Appendix of your book (Page A-2) has the following chart

### Common multivalent metals and their charges

Cobalt	$\text{Co}^{+2}$	$\text{Co}^{+3}$
Copper	$\text{Cu}^{+1}$	$\text{Cu}^{+2}$
Iron	$\text{Fe}^{+2}$	$\text{Fe}^{+3}$
Lead	$\text{Pb}^{+2}$	$\text{Pb}^{+4}$
Manganese	$\text{Mn}^{+2}$	$\text{Mn}^{+3}$
Mercury	$\text{Hg}_2^{+2}$	$\text{Hg}^{+2}$
Tin	$\text{Sn}^{+2}$	$\text{Sn}^{+4}$

## Multivalent Ionic Compounds Name to Formula

## Multivalent Metals Name to Formula

- Names will...
  - contain roman numerals
- To write formulas:
  - Same as binary, except Roman numerals tell the charge of the metal cation

## Example #5

**Iron (III) oxide**

## Example #6

**Copper (I) nitride**

## Let's Practice

Example:  
Write the  
following  
chemical  
formulas

Iron (II) nitride

Copper (I) chloride

Lead (IV) sulfide

Tin (II) oxide

## Let's Practice

Example:  
Write the  
following  
chemical  
formulas

Iron (II) nitride  $\text{Fe}_3\text{N}_2$

Copper (I) chloride  $\text{CuCl}$

Lead (IV) sulfide  $\text{PbS}_2$

Tin (II) oxide  $\text{SnO}$

**Multivalent Ionic Compounds  
Formula to Name**

## Multivalent Metals Formula to Name

- Formulas will:
  - Contain a transition metal
- To name:
  1. Name of the metal cation
  2. Name of the anion
  3. Determine total negative charge
  4. Total negative charge must = total positive charge
  5. Determine the charge on each metal atom
  6. Write the charge in roman numerals in parenthesis after the metal's name

## Example #8



## Example #9



## Let's Practice

Example:  
Write the name  
for the following  
compounds



## Let's Practice

Example:  
Write the name  
for the following  
compounds



## Polyatomic Ionic Compounds

## Polyatomic Ions

**Polyatomic Ion:** *more than one atom* that together have a charge

**Polyatomic Ionic Compound:** compound containing at least one polyatomic ion

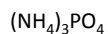


## Help Identifying Polyatomic Ions

- Only cation polyatomic ion:  $\text{NH}_4$
- All other polyatomic ions are anions (back-half)
- Subscripts must match **exactly** as it appears on your list
- If there are parenthesis, the polyatomic ion is inside

## Practice Identifying Polyatomic Ions

**Example:**  
Identify and name the polyatomic ion in each compound



## Practice Identifying Polyatomic Ions

**Example:**  
Identify and name the polyatomic ion in each compound



Nitrate



Ammonium



Hydroxide



Ammonium & phosphate



Carbonate

## Polyatomic Ionic Compounds Name to Formula

### Polyatomic Ionic Name to Formula

- *Names...*
    - Do not end with “-ide” (except hydroxide & cyanide)
    - Do not use covalent prefixes
  - *To write formulas:*
    1. Write the symbol & charge of the cation & anion
    2. Add additional cations or anions to have a neutral compound
    3. Use subscripts to show the number of ion
- When using subscripts with a polyatomic ion, you must put the polyatomic ion in parenthesis.**

### Example #3

Sodium carbonate

### Example #4

Magnesium nitrate

### Let's Practice

Example:  
Write the  
following  
chemical  
formulas

Sodium nitrate

Calcium chlorate

Potassium sulfite

Calcium hydroxide

### Let's Practice

Example:  
Write the  
following  
chemical  
formulas

Sodium nitrate

$\text{NaNO}_3$

Calcium chlorate

$\text{Ca}(\text{ClO}_3)_2$

Potassium sulfite

$\text{K}_2\text{SO}_3$

Calcium hydroxide

$\text{Ca}(\text{OH})_2$

## Polyatomic Ionic Compounds Formula to Name

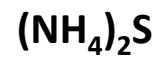
### Polyatomic Ionic Formula to Name

- *Formulas will...*
  - Contain more than 2 elements (not starting with H)
  - at least 1 metal and 1 non-metal
- *To name:*
  1. Name of the cation
  2. If the anion is a polyatomic ion, write the polyatomic ion's name **just as it is**
  3. If the anion is a single non-metal element, use "-ide"

Example #1



Example #2



Let's Practice

**Example:**  
Write the name  
for the following  
compounds

