

## Activity One: Binary Ionic Compounds Composed of Main Group Elements

This activity focuses on the nomenclature rules for ionic compounds composed of two different elements from select groups on the periodic table of elements. All of the compounds listed below are composed of elements located in groups I, II, III, IV, V, VI, and VII on the periodic table of elements. Collectively, these elements are known as the main group elements.

### Observing the Patterns

Consider the following group of formulas and their corresponding names. Examine the formulas and names carefully to identify patterns associated with naming compounds. Use only a periodic table as a reference but no other outside resources, such as your textbook or the Internet.

#### Chemical Formula

NaBr

AlP

CaF<sub>2</sub>

K<sub>2</sub>O

Mg<sub>3</sub>N<sub>2</sub>

#### Written Form

sodium bromide

aluminum phosphide

calcium fluoride

potassium oxide

magnesium nitride

Write down the patterns you observe in the both the chemical formula and written form for the compounds above. These patterns will later be used to establish the rules by which these compounds were named.

### The Rules

Use the patterns you observed to construct a set of rules for the nomenclature of binary ionic compound composed of main group elements. Be certain that the rules you establish can be used to work from the chemical formula to the written form and vice versa. Write these rules below.

Use the rules you have determined above to write the formulas of the following binary ionic compounds. Do these exercises without using your textbook.

calcium chloride

aluminum oxide

magnesium sulfide

cesium nitride

lithium phosphide

potassium fluoride

rubidium selenide

barium iodide

Use the rules you have determined to write the names of the following binary ionic compounds. Do these exercises without using your textbook.

$\text{SrCl}_2$

$\text{BaO}$

$\text{Na}_2\text{S}$

$\text{Cs}_3\text{N}$

$\text{LiI}$

$\text{MgF}_2$

$\text{K}_3\text{P}$

$\text{CaSe}$

## Activity Two: Binary Ionic Compounds Containing Variably Charged Cations

A portion of the nomenclature system was introduced in Activity One and used to name binary ionic compounds composed of main group elements. However, there are numerous binary ionic compounds that contain metals capable of possessing more than one possible charge as a cation. This activity builds upon the previous experiences of converting observed patterns in both chemical formulas and written forms into a set of rules that can be used to name all types of binary ionic compounds.

### Observing the Patterns

Consider the following group of formulas and their corresponding names. Examine the formulas and names carefully to identify patterns associated with naming compounds. Use only a periodic table as a reference but no other outside resources, such as your textbook or the Internet.

<u>Chemical Formula</u>	<u>Written Form</u>
Fe <sub>2</sub> O <sub>3</sub>	iron(III) oxide
FeCl <sub>2</sub>	iron(II) chloride
PbS	lead(II) sulfide
AlP	aluminum phosphide
CuF <sub>2</sub>	copper(II) fluoride
SnI <sub>4</sub>	tin(IV) iodide
KBr	potassium bromide

Write down the patterns you observe in the both the chemical formula and written form for the compounds above. These patterns will later be used to establish the rules by which these compounds were named.

### The Rules

Use the patterns you observed to construct a set of rules for the nomenclature of all binary ionic compounds. Be certain that the rules you establish can be used to work from the chemical formula to the written form and vice versa. Write these rules below.

Use the rules you have determined above to write the formulas of the following binary ionic compounds.

cobalt(III) oxide

iron(III) chloride

copper(II) bromide

lithium arsenide

chromium(III) sulfide

lead(IV) iodide

potassium nitride

iron(II) phosphide

Use the rules you have determined to write the names of the following binary ionic compounds.

$\text{MnF}_2$

$\text{Ni}_3\text{P}_2$

$\text{PbO}_2$

$\text{Cs}_2\text{S}$

$\text{ScCl}_3$

$\text{MgI}_2$

$\text{PbS}$

$\text{CuSe}$

### Activity Three: Ionic Compounds Containing Polyatomic Ions

The chemical nomenclature system was introduced in Activity One and further developed in Activity Two. Both of these activities limited themselves to ionic compounds composed only of two elements, or binary ionic compounds. Activity Three introduces polyatomic ions, or ions containing two or more atoms covalently bonded and bearing a charge. This activity builds upon the previous experiences of converting observed patterns in chemical formulas and written forms into a set of rules that can be used to name all types of ionic compounds.

Here is a list of common polyatomic ions:

ammonium	$\text{NH}_4^+$
nitrate	$\text{NO}_3^-$
sulfate	$\text{SO}_4^{2-}$
carbonate	$\text{CO}_3^{2-}$
phosphate	$\text{PO}_4^{3-}$
acetate	$\text{C}_2\text{H}_3\text{O}_2^-$
hydroxide	$\text{OH}^-$
cyanide	$\text{CN}^-$
hydrogen carbonate	$\text{HCO}_3^-$

#### Observing the Patterns

Consider the following group of formulas and their corresponding names. Examine the formulas and names carefully to identify patterns associated with naming compounds. Use only a periodic table as a reference but no other outside resources, such as your textbook or the Internet.

<u>Chemical Formula</u>	<u>Written Form</u>
$(\text{NH}_4)_2\text{S}$	ammonium sulfide
$\text{CoSO}_4$	cobalt(II) sulfate
$\text{Fe}(\text{OH})_3$	iron(III) hydroxide
$\text{Ca}_3(\text{PO}_4)_2$	calcium phosphate
$\text{NH}_4\text{NO}_3$	ammonium nitrate

Write down the patterns you observe in the both the chemical formula and written form for the compounds above. These patterns will later be used to establish the rules by which these compounds were named.

### The Rules

Use the patterns you observed to construct a set of rules for the nomenclature of binary ionic compound composed of main group elements. Be certain that the rules you establish can be used to work from the chemical formula to the written form and vice versa. Write these rules below.

Use the rules you have determined above to write the formulas of the following binary ionic compounds.

iron(III) acetate

aluminum hydroxide

strontium sulfate

lead(II) sulfate

copper(I) sulfide

ammonium nitride

potassium cyanide

magnesium carbonate

Use the rules you have determined to write the names of the following binary ionic compounds.

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

$\text{Sn}(\text{C}_2\text{H}_3\text{O}_2)_2$

$\text{Zn}_3(\text{PO}_4)_2$

$\text{Pb}(\text{NO}_3)_2$

$\text{NaHCO}_3$

$\text{NiCO}_3$

$\text{NH}_4\text{F}$

$\text{MgSO}_4$

## Activity Four: Binary Compounds of the Nonmetals

The previous activities have introduced the nomenclature system and its use in naming ionic compounds. The rules for naming binary compounds composed of nonmetals are explored in this activity, building upon the previous experiences of converting observed patterns in chemical formulas and written forms into a set of rules that can be used to name binary compounds of the nonmetals.

### Determining the rules

Consider the following group of formulas and their corresponding names. Examine the formulas and names carefully to identify patterns associated with naming molecules. Use only a periodic table as a reference but no other outside resources, such as your textbook or the Internet.

#### Chemical Formula

NF<sub>3</sub>  
NO  
NO<sub>2</sub>  
N<sub>2</sub>O  
N<sub>2</sub>O<sub>4</sub>

#### Written Form

Nitrogen trifluoride  
Nitrogen monoxide  
Nitrogen dioxide  
Dinitrogen monoxide  
Dinitrogen tetroxide

Write down the patterns you observe in the both the chemical formula and written form for the compounds above. These patterns will later be used to establish the rules by which these compounds were named.

### The Rules

Use the patterns you observed to construct a set of rules for the nomenclature of all binary ionic compounds. Be certain that the rules you establish can be used to work from the chemical formula to the written form and vice versa. Write these rules below.

Use the rules you have determined above to write the formulas of the following molecules.

carbon dioxide

dihydrogen monoxide

phosphorus triiodide

sulfur dichloride

boron trifluoride

dioxygen difluoride

phosphorus pentachloride

sulfur hexafluoride

Use the rules you have determined to write the names of the following molecules.

$N_2H_4$

$OF_2$

$SBr_2$

$BCl_3$

$XeF_4$

$ClF_3$

$P_4O_3$

$CS_2$