# NOMENCLATURE
# EXPERIMENT 9

**OBJECTIVE**

The objective of this assignment is to write the names of compounds using their formulas.

**DISCUSSION**

The naming of inorganic compounds can be broken down into two areas: binary compounds (two elements) and ternary compounds (more than two elements).

In this exercise a flow chart will be utilized. The flow chart will ask three questions in a strict order with a yes or no answer for each question.

The questions are as follows:

1. Are there more than two elements in the compound?
2. Is there a metal?
3. Does the metal have a fixed oxidation number?

Depending on the answer to each question (yes or no), the correct name of the compound can be determined.

A review of oxidation numbers and polyatomics ions needs to be covered first.

**Oxidation Numbers**

Using a periodic table, many of the oxidation numbers of the representative elements can be determined.

The elements in Group IA all have oxidation numbers of +1.
The elements in Group IIA all have oxidation numbers of +2.
The elements in Group IIIA all have oxidation numbers of +3.

The non-metals in Group V have oxidation numbers –3.
The non-metals in Group VI have oxidation numbers –2.
The non-metals in Group VII have oxidation numbers –1.

There are some transition elements that have fixed oxidation numbers (the number remains the same).

Zn = +2 Ag = +1

There are also many metals that have more than one oxidation number (variable oxidation numbers).

Fe = +2 or +3 Cu and Hg = +1 or +2 Pb and Sn = +2 or +4

The following is a list of common polyatomic ions.

| Common Polyatomic Ions | | | | | |
|---|---|---|---|---|---|
| sulfate | $SO_4^{-2}$ | Nitrate | $NO_3^{-1}$ | acetate | $C_2H_3O_2^{-1}$ |
| sulfite | $SO_3^{-2}$ | Nitrite | $NO_2^{-1}$ | bicarbonate | $HCO_3^{-1}$ |
| carbonate | $CO_3^{-2}$ | Oxalate | $C_2O_4^{-2}$ | bisulfite | $HSO_3^{-1}$ |
| ammonium | $NH_4^{+1}$ | chromate | $CrO_4^{-2}$ | bisulfate | $HSO_4^{-1}$ |
| hypochlorite | $ClO^{-1}$ | dichromate | $Cr_2O_7^{-2}$ | phosphate | $PO_4^{-3}$ |
| chlorite | $ClO_2^{-1}$ | permanganate | $MnO_4^{-1}$ | phosphite | $PO_3^{-3}$ |
| chlorate | $ClO_3^{-1}$ | hydroxide | $OH^{-1}$ | | |
| perchlorate | $ClO_4^{-1}$ | Cyanide | $CN^{-1}$ | | |

Treat the polyatomic ions as units. The oxidation number is for the entire polyatomic ion.

There are two ways to determine which oxidation number to use for variable oxidation metals: either be told what it is or calculate the oxidation number.

**Calculating Oxidation Numbers**

In a chemical formula, the positive oxidation component is written first followed by the negative component.

For a chemical formula to be balanced, the total number of electrons being given away must equal the number of electron being accepted. This means that the sum of the positive oxidation numbers must equal the sum of the negative oxidation numbers. The total sum of all the oxidation numbers must equal zero.

In order to calculate the oxidation number of a variable metal, we reverse the process used to write the formula.

The sum of all the oxidation numbers must be zero. If the oxidation numbers of all the anions (- oxidation numbers) are added together, they must equal the sum of all the cations (+ oxidation numbers). Since the variable metals will always have positive oxidation numbers, we can determine their oxidation numbers using simple arithmetic.

Example: Determining the oxidation number of Cu in $CuCl_2$

The sum of all the oxidation numbers equal zero.

Cu is a metal therefore will have a positive oxidation number.

If copper has a positive oxidation number, then chlorine must be negative.

Chlorine is in group VIIA. Group VIIA elements that are negative have a –1 oxidation number.

There are two chlorine atoms ($Cl_2$). Each is a $Cl^{-1}$ therefore the total of the negative oxidation numbers would be –2. *(2 x –1 = -2)*

In order for $CuCl_2$ to have an overall charge of zero, the oxidation number of all the coppers (in this case only one) must equal +2. *(+2 –1 –1 = 0)*

This means the oxidation number of Cu in $CuCl_2$ is +2.

Example: Determining the oxidation number of Fe in $Fe_2O_3$

The sum of all the oxidation numbers equal zero.

Fe is a metal therefore will have a positive oxidation number.

If iron has a positive oxidation number, then oxygen must be negative.

Oxygen is in group VIA. Group VIIA elements that are negative have a –2 oxidation number.

There are three oxygen atoms ($O_3$). Each is a $O^{-2}$ therefore, the total of the negative oxidation numbers would be –6. *(3 x –2 = -6)*

In order for $Fe_2O_3$ to have an overall charge of zero, the oxidation number of all the irons (in this case two atoms) must equal +6. *(+6 –2 –2 –2 = 0)*

The +6 oxidation number is due to two atoms of iron ($Fe_2$). Therefore, each atom of iron would have an oxidation number of +3. *(+6 / 2 = +3)*

This means the oxidation number of Fe in $Fe_2O_3$ is +3.

Example: Determining the oxidation number of Sn in $Sn_3(PO_4)_2$

The sum of all the oxidation numbers equal zero.

Sn is a metal therefore will have a positive oxidation number.

If tin has a positive oxidation number, then the phosphate must be negative.

Phosphates ($PO_4^{-3}$) have a –3 oxidation number.

There are two phosphate ions ($PO_4^{-3}$). Since each phosphate ion has a –3 oxidation number, the total of the negative oxidation numbers would be –6. *(2 x –3 = -6)*

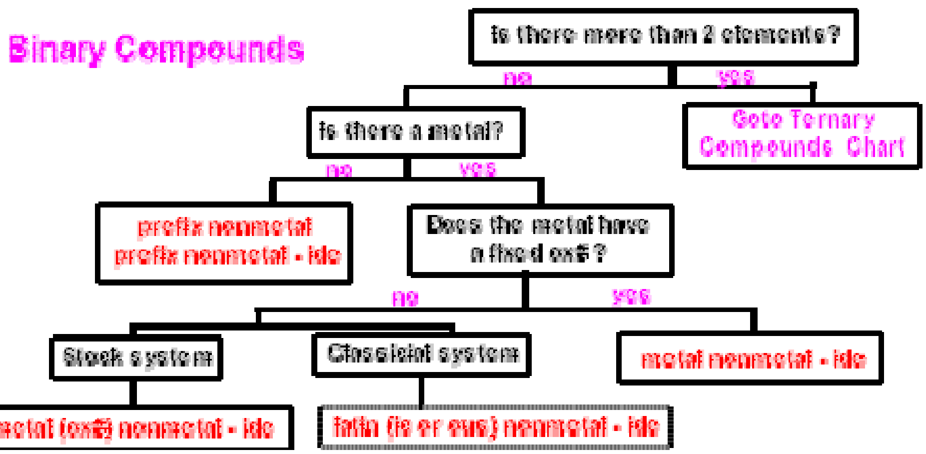
In order for $Sn_3(PO_4)_2$ to have an overall charge of zero, the oxidation number of all the tins (in this case three atoms) must equal +6. *(+6 –3 –3 = 0)*

The +6 oxidation number is due to three atoms of tin ($Sn_3$). Therefore each atom of tin would have an oxidation number of +2. *(+6 / 3 = +2)*

This means the oxidation number of Sn in $Sn_3(PO_4)_2$ is +2.

**Naming Binary Compounds**

The flow chart below can be used to determine the names of binary compounds (compounds with only two elements).




Notice that the names of all binary compounds end with an **ide** attached to a nonmetal.

Examples: oxygen = ox**ide** sulfur = sulf**ide** chlorine = chlor**ide**

In using the flow chart, the first question asked is: *Is there more than two elements?*

Look at the formula and if there is only two different elements (not the number of atoms) in the formula than the answer is **no** and the compound is binary and will end in **ide**.

Example: $MgCl_2$ has only two elements: Mg and Cl (binary)

$MgSO_4$ has three elements: Mg, S and O (ternary)

**Binary Compounds with a Fixed Oxidation Metal**

In using the flow chart, the second question asked is: *Is there a metal?*

Look at the formula and determine if there is a metal in the compound (hint: remember the staircase in the periodic table).

There are two possible answers to this question (yes or no).

Example: $MgCl_2$ : magnesium is a metal therefore the answer is **yes**
$N_2O_3$ : neither nitrogen or oxygen is a metal therefore the answer is **no**

If there is a metal in the formula, the third question asked is: *Does the metal have a fixed oxidation number?*

Look at the formula and determine if there is a metal in the compound has a fixed oxidation number (hint: remember the prior discussion on oxidation numbers)

There are two possible answers to this question (yes or no).

Example: $MgCl_2$ : magnesium is in Group IIA and all elements in Group IIA have fixed oxidation numbers of +2 therefore the answer is **yes.**

$FeCl_2$ : iron has a variable oxidation number of either +2 or +3 and is not fixed therefore the answer is **no.**

If the compound is binary and the metal has a fixed oxidation number, the compound would be named as follows**:** ***metal nonmetal - ide***

Example: $MgCl_2$ : magnesium chloride
$Al_2O_3$ : aluminum oxide

Example: Determine the name for $BaCl_2$

Is there more than two elements: NO
Is there a metal: YES
Is the metal fixed: YES
Format: metal nonmetal followed with ide
Answer: barium chloride

Example: $Al_2O_3$

Is there more than two elements: NO
Is there a metal: YES
Is the metal fixed: YES
Format: metal nonmetal followed with ide
Answer: aluminum oxide

**Binary Compounds with a Variable Oxidation Metal**

In using the flow chart, the second question asked is: *Is there a metal?*

Look at the formula and determine if there is a metal in the compound (hint: remember the staircase in the periodic table).

There are two possible answers to this question (yes or no).

Example: $FeCl_3$ : iron is a metal therefore the answer is **yes**
$N_2O_3$ : neither nitrogen or oxygen is a metal therefore the answer is **no**

If there is a metal in the formula, the third question asked is: *Does the metal have a fixed oxidation number?*

Look at the formula and determine if there is a metal in the compound has a fixed oxidation number (hint: remember the prior discussion on oxidation numbers).

There are two possible answers to this question (yes or no).

Example: $MgCl_2$ : magnesium is in Group IIA and all elements in Group IIA have fixed oxidation numbers of +2 therefore the answer is **yes.**

$FeCl_3$ : iron has a variable oxidation number of either +2 or +3 and is not fixed therefore the answer is **no.**

If the compound is binary and the metal has a variable oxidation number, the next step is to determine the oxidation number of the metal. Refer to the *Calculating Oxidation Numbers* section for the procedure. The oxidation number must be determined since in the naming of the compound, the type of ion (the oxidation number) must be indicated in the name:

Example: Fe +2 or Fe +3
Cu +1 or Cu +2

This is very important because the different ions given different physical and chemical properties to the compound.

Example: $FeCl_2$ ($Fe^{+2}$) has different chemical and physical properties than $FeCl_3$ ($Fe^{+3}$).

If the compound is binary and the metal has a variable oxidation number, the next step is to determine which naming scheme for binary compounds with variable oxidation numbers will be used.

There are two systems: Stock and Classical

The system used depends on the individual, the industry or the company the name needs to be communicated to; some use the Stock System and some the Classical System.

The Stock System is the easiest to use since it gives all the information needed in the name without remembering the various oxidation numbers of the variable metals.

To name a binary compound with a variable metal using the Stock System, the compound would be named as follows**:** ***metal (oxidation number) nonmetal - ide***

The oxidation number of the metal would be written using roman numerals enclosed in parenthesis to indicate the positive oxidation number of the metal.

Example: +1 = (I) +2 = (II) +3 = (III) +4 = (IV) +5 = (V) +6 = (VI) +7 = (VII)

Example: $FeCl_3$ would be iron (III) chloride

$FeCl_2$ would be iron (II) chloride

The Classical System is a bit more difficult. The Classical System assumes the different oxidation numbers of the variable metals are known, the Latin names of the metals, and a bit of Latin grammar.

The oxidation numbers some of the variable metals have already been given:

Fe = +2 or +3 Cu and Hg = +1 or +2 Pb and Sn = +2 or +4

The Latin names of these elements are as follows:

Fe = ferr Sn = stann Pb = plumb Cu = cupr

Hg uses mercur instead of the true Latin name.

Latin has two suffixes (attached to the end of a name) to indicate rank: **ic** and **ous.**

Names ending with –ic are of a higher order than those ending in –ous.

Metals with a higher oxidation number have an –**ic** after their latin name and those with the lower oxidation use an **-ous**.

Example: $Fe^{+2}$ = ferrous $Fe^{+3}$ = ferric

$Cu^{+1}$ = cuprous $Cu^{+2}$ = cupric

To name a binary compound with a variable metal using the Classical System, the compound would be named as follows**:** ***metal in Latin ic or ous nonmetal - ide***

Example: $FeCl_3$ (+3 oxidation number) would be ferric chloride

$FeCl_2$ (+2 oxidation number) would be ferrous chloride.

Example: $Fe_2O_3$

Are there more than two elements: NO
Is there a metal: YES
Is the metal fixed: NO

Format:
Stock: metal (ox # in roman numerals) nonmetal followed with ide
Classical: Latin metal name (ic or ous) nonmetal followed with ide

Answer: iron (III) oxide or ferric oxide

Example: CuCl

Is there more than two elements: NO
Is there a metal: YES
Is the metal fixed: NO

Format:
Stock: metal (ox # in roman numerals) nonmetal followed with ide
Classical: latin metal name (ic or ous) nonmetal followed with ide

Answer: copper (I) chloride or cuprous chloride

**Binary Compounds with Two Nonmetals**

In using the flow chart, the second question asked is: *Is there a metal?*

Look at the formula and determine if there is a metal in the compound (hint: remember the staircase in the periodic table).

There are two possible answers to this question (yes or no).

Example: $FeCl_3$ : magnesium is a metal therefore the answer is **yes**

$N_2O_3$ : neither nitrogen or oxygen is a metal therefore the answer is **no**

If neither element is a metal, we have a binary compound with two nonmetals.

A compound with two nonmetals can exist in numerous forms with a different number of atoms of each nonmetallic element.

Example: NO $N_2O$ $NO_2$ $NO_3$ $N_2O_3$

To name a binary compound with two nonmetals, the compound would be named as follows**:**

***prefix nonmetal prefix nonmetal – ide***

The prefix indicates the number of atoms of that particular nonmetal. The prefixes are as follows:

| | | | | |
|---|---|---|---|---|
| mono = 1 | di = 2 | tri = 3 | tetra = 4 | pent = 5 |
| hex = 6 | hept = 7 | oct = 8 | non = 9 | dec = 10 |

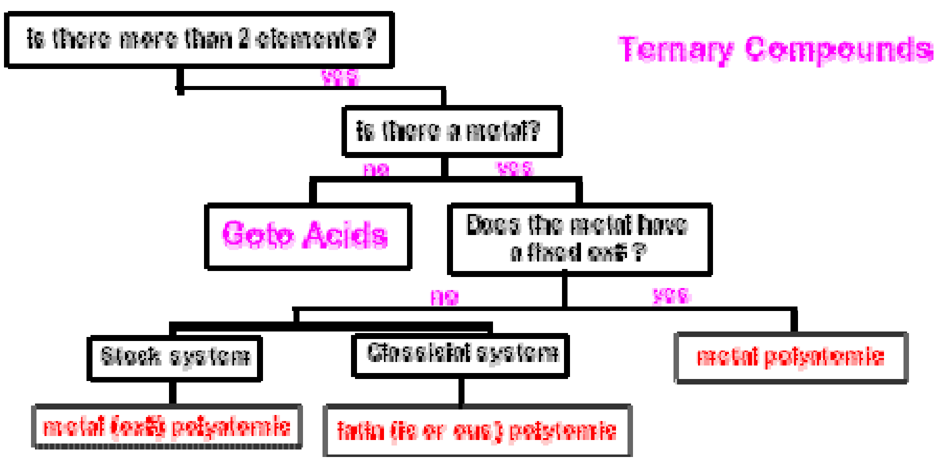
The prefix mono is normally omitted unless its presence is necessary to avoid confusion. The only common exceptions are for carbon monoxide and nitrogen monoxide.

| | | |
|---|---|---|
| Example: | $NO$ | nitrogen monoxide |
| | $N_2O$ | dinitrogen oxide |
| | $NO_2$ | nitrogen dioxide |
| | $NO_3$ | nitrogen trioxide |
| | $N_2O_3$ | dinitrogen trioxide |

At this point in time, never use a prefix if there is a metal in the formula.

**Naming Ternary Compounds**

The flow chart below can be used to determine the names of ternary compounds (compounds with more than two elements).




Notice that the names of all the ternary compounds end with the name of a polyatomic ion.

The only real difference between the flow chart for binary compounds and ternary compounds is that all binary compounds end in a nonmetal –ide and all the ternary compounds end in a polyatomic.

In using the flow chart, the first question asked is: *Is there more than two elements?*

Look at the formula and if there is only two different elements (not the number of atoms) in the formula than the answer is **no** and the compound is binary and will end in **ide**.

Example: $MgCl_2$ has only two elements: Mg and Cl (binary)
$MgSO_4$ has three elements: Mg, S and O (ternary)

**Ternary Compounds with a Fixed Oxidation Metal**

In using the flow chart, the second question asked is: *Is there a metal?*

Look at the formula and determine if there is a metal in the compound (hint: remember the staircase in the periodic table).

There are two possible answers to this question (yes or no).

Example: $MgSO_4$ : magnesium is a metal therefore the answer is **yes**

**No** will not be covered in this exercise.

If there is a metal in the formula, the third question asked is: *Does the metal have a fixed oxidation number?*

Look at the formula and determine if there is a metal in the compound has a fixed oxidation number (hint: remember the prior discussion on oxidation numbers)

There are two possible answers to this question (yes or no).

Example: $MgSO_4$ : magnesium is in Group IIA and all elements in Group IIA have fixed oxidation numbers of +2 therefore the answer is **yes.**

$FeSO_4$ : iron has a variable oxidation number of either +2 or +3 and is not fixed therefore the answer is **no.**

If the compound is ternary and the metal has a fixed oxidation number, the compound would be named as follows**:** ***metal polyatomic***

Example: $MgSO_4$ : magnesium sulfate
$Al_2(CO_3)_2$ : aluminum carbonate

Example: Determine the name for $Ba(NO_3)_2$

Is there more than two elements: YES
Is there a metal: YES
Is the metal fixed: YES
Format: metal followed with the name of the polyatomic ion
Answer: barium nitrate

Example: Determine the name for $Na_2SO_4$

Is there more than two elements: YES
Is there a metal: YES
Is the metal fixed: YES
Format: metal followed with the name of the polyatomic ion
Answer: sodium sulfate

**Ternary Compounds with a Variable Oxidation Metal**

In using the flow chart, the second question asked is: *Is there a metal?*

Look at the formula and determine if there is a metal in the compound (hint: remember the staircase in the periodic table).

There are two possible answers to this question (yes or no).

Example: $FeSO_4$ : magnesium is a metal therefore the answer is **yes**
**No** will not be covered in this exercise.

If there is a metal in the formula, the third question asked is: *Does the metal have a fixed oxidation number?*

Look at the formula and determine if there is a metal in the compound has a fixed oxidation number (hint: remember the prior discussion on oxidation numbers)

There are two possible answers to this question (yes or no).

Example: $MgSO_4$ : magnesium is in Group IIA and all elements in Group IIA have fixed oxidation numbers of +2 therefore the answer is **yes.**

$FeSO_4$ : iron has a variable oxidation number of either +2 or +3 and is not fixed therefore the answer is **no.**

If the compound is ternary and the metal has a variable oxidation number, the next step is to determine the oxidation number of the metal. Refer to the *Calculating Oxidation Numbers* section for the procedure. The oxidation number must be determined since in the naming of the compound, the type of ion (the oxidation number) must be indicated in the name:

Example: Fe +2 or Fe +3
Cu +1 or Cu +2

This is very important because the different ions given different physical and chemical properties to the compound.

Example: $FeSO_4$ where iron = +2 has different chemical and physical properties than $Fe_2(SO_4)_3$ where iron = +3.

If the compound is ternary and the metal has a variable oxidation number, the next step is to determine which naming scheme for binary compounds with variable oxidation numbers will be used.

There are two systems: Stock and Classical

The system used depends on the individual, the industry or the company the name needs to be communicated to; some use the Stock System and some the Classical System.

The Stock System is the easiest to use since it gives all the information needed in the name without remembering the various oxidation numbers of the variable metals.

To name a binary compound with a variable metal using the Stock System, the compound would be named as follows**:** ***metal (oxidation number) polyatomic ion***

The oxidation number if the metal would be written using roman numerals enclosed in parenthesis to indicate the positive oxidation number of the metal.

Example: +1 = (I) +2 = (II) +3 = (III) +4 = (IV) +5 = (V) +6 = (VI) +7 = (VII)

Example: $FeSO_4$ would be iron (II) sulfate
$Fe_2(SO_4)_3$ would be iron (III) sulfate

The Classical System is a bit more difficult. The Classical System assumes the different oxidation numbers of the variable metals are known, the Latin names of the metals, and a bit of Latin grammar.

The oxidation numbers some of the variable metals have already been given:

Fe = +2 or +3 Cu and Hg = +1 or +2 Pb and Sn = +2 or +4

The Latin names of these elements are as follows:

Fe = ferr Sn = stann Pb = plumb Cu = cupr

Hg uses mercur instead of the true Latin name.

Latin has two suffixes (attached to the end of a name) to indicate rank: **ic** and **ous.**

Names ending with –ic are of a higher order than those ending in –ous.

Metals with a higher oxidation number have an –**ic** after their latin name and those with the lower oxidation use an **-ous**.

Example: $Fe^{+2}$ = ferrous $Fe^{+3}$ = ferric
$Cu^{+1}$ = cuprous $Cu^{+2}$ = cupric

To name a ternary compound with a variable metal using the Classical System, the compound would be named as follows**:** ***metal in Latin ic or ous followed by the name of the polyatomic ion.***

Example: $FeSO_4$ (+2 oxidation number) would be ferrous sulfate

$Fe_2(SO_4)_3$ (+3 oxidation number) would be ferric sulfate

Example: $Fe_2(SO_4)_3$

Are there more than two elements: YES
Is there a metal: YES
Is the metal fixed: NO

Format:
Stock: metal (ox # in roman numerals) followed with polyatomic
Classical: Latin metal name (ic or ous) followed with polyatomic

Answer: iron (III) sulfate or ferric sulfate

Example: $CuNO_3$

Is there more than two elements: YES
Is there a metal: YES
Is the metal fixed: NO

Format:
Stock: metal (ox # in roman numerals) followed with polyatomic
Classical: Latin metal name (ic or ous) followed with polyatomic

Answer: copper (I) nitrate or cuprous nitrate

Example: $Fe_3(PO_4)_2$

Is there more than two elements: YES
Is there a metal: YES
Is the metal fixed: NO

Format:
Stock: metal (ox # in roman numerals) followed with polyatomic
Classical: Latin metal name (ic or ous) followed with polyatomic

Answer: iron (II) phosphate or ferrous phosphate

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NAME ___________________
DATE ____________________
SECTION _________________

# NAMING FORMULAS
# REPORT SHEET
# EXPERIMENT 9

**BINARY COMPOUNDS**

Complete the following tables by naming the compounds that are a combination of the anions and the cations.

| Cation | Anion | | | |
|---|---|---|---|---|
| | $F^{-1}$ | $Cl^{-1}$ | $Br^{-1}$ | $I^{-1}$ |
| $Li^{+1}$ | | | | |
| $Na^{+1}$ | | | | |
| $K^{+1}$ | | | | |
| $Mg^{+2}$ | | | | |
| $Ca^{+2}$ | | | | |
| $Ba^{+2}$ | | | | |
| $Al^{+3}$ | | | | |
| $Zn^{+2}$ | | | | |

Complete the following tables by naming the compounds that are a combination of the anions and the cations (if the metal is variable, use both the Stock and Classical System).

| Cations | Anions | | | |
|---|---|---|---|---|
| | $N^{-3}$ | $O^{-2}$ | $S^{-2}$ | $P^{-3}$ |
| $Li^{+1}$ | | | | |
| $K^{+1}$ | | | | |
| $Mg^{+2}$ | | | | |
| $Al^{+3}$ | | | | |

| | $N^{-3}$ | $O^{-2}$ | $S^{-2}$ | $P^{-3}$ |
|---|---|---|---|---|
| $Fe^{+2}$ | | | | |
| $Fe^{+3}$ | | | | |
| $Pb^{+4}$ | | | | |
| $Cu^{+1}$ | | | | |
| $Ag^{+1}$ | | | | |

Write the names of the following formulas (if the metal is variable, use both the Stock and Classical System).

| Formula | |
|---|---|
| $FeCl_2$ | |
| $FeCl_3$ | |
| $P_2O_5$ | |
| CuCl | |
| $Al_2O_3$ | |
| $SnCl_4$ | |
| $H_2S$ | |
| $Ba_3N_2$ | |
| $PbCl_4$ | |
| $Hg_2Cl_2$ | |
| $MgCl_2$ | |
| $Fe_2O_3$ | |
| $S_2O_3$ | |
| $Na_2S$ | |

| | |
|---|---|
| $Cu_2O$ | |
| $SnO_2$ | |
| $SO_2$ | |
| $SnO$ | |
| $PbO_2$ | |
| $FeS$ | |
| $Fe_2S_3$ | |
| $Cu_2S$ | |
| $SnS_2$ | |
| $N_2O_3$ | |
| $SnS$ | |
| $Cu_3N$ | |
| $Sn_3N_4$ | |

## TERNARY COMPOUNDS

Complete the following tables by naming the compounds that are a combination of the anions and the cations (if the metal is variable, use both the Stock and Classical System).

| Cations | Polyatomic anions | | | |
|---|---|---|---|---|
| | $SO_4^{-2}$ | $NO_3^{-1}$ | $CO_3^{-2}$ | $OH^{-1}$ |
| $Li^{+1}$ | | | | |
| $Mg^{+2}$ | | | | |
| $Ca^{+2}$ | | | | |
| $Al^{+3}$ | | | | |

| | $SO_4^{-2}$ | $NO_3^{-1}$ | $CO_3^{-2}$ | $OH^{-1}$ |
|---|---|---|---|---|
| $Fe^{+2}$ | | | | |
| $Fe^{+3}$ | | | | |
| $Pb^{+4}$ | | | | |
| $Cu^{+1}$ | | | | |
| $Ag^{+1}$ | | | | |

Complete the following tables by naming the compounds that are a combination of the anions and the cations (if the metal is variable, use both the Stock and Classical System).

| Cations | Polyatomic anions | | | |
|---|---|---|---|---|
| | $PO_4^{-3}$ | $ClO_3^{-1}$ | $CN^{-1}$ | $HCO_3^{-1}$ |
| $Na^{+1}$ | | | | |
| $Cs^{+1}$ | | | | |
| $Be^{+2}$ | | | | |
| $Ca^{+2}$ | | | | |
| $Sr^{+2}$ | | | | |
| $Al^{+3}$ | | | | |
| $Fe^{+2}$ | | | | |
| $Fe^{+3}$ | | | | |
| $Pb^{+4}$ | | | | |
| $Cu^{+1}$ | | | | |

Write the names of the following formulas:

| Formula | Stock | Classical |
|---|---|---|
| $Fe(NO_3)_2$ | | |
| $BaSO_4$ | | |
| $CuNO_3$ | | |
| $Cu(NO_3)_2$ | | |
| $Sn(NO_3)_2$ | | |
| $Al(NO_3)_3$ | | |
| $Pb(NO_3)_4$ | | |
| $Ba(ClO_3)_2$ | | |
| $FeCO_3$ | | |
| $Na_2CO_3$ | | |
| $Cu_2CO_3$ | | |
| $Sn(CO_3)_2$ | | |
| $SnCO_3$ | | |
| $Pb(CO_3)_2$ | | |
| $PbCO_3$ | | |
| $Mg_3(PO_4)_2$ | | |
| $Fe_3(PO_4)_2$ | | |
| $CuOH$ | | |
| $Cu(OH)_2$ | | |
| $Sn(SO_4)_2$ | | |
| $SnSO_4$ | | |
| $CuCN$ | | |
| $Pb(C_2H_3O_2)_4$ | | |