

## NAMING COMPOUNDS AND WRITING FORMULAS

+1												+4		-3		-2		-1		0			
IA												III A	IV A	V A	VIA	VII A	VIII A						
1	2											3	4	5	6	7	8	9	10				
H	He											B	C	N	O	F	Ne						
3	4											13	14	15	16	17	18						
Li	Be											Al	Si	P	S	Cl	Ar						
11	12											29	30	31	32	33	34	35	36				
Na	Mg											Cu	Zn	Ga	Ge	As	Se	Br	Kr				
19	20	21	22											47	48	49	50	51	52	53	54		
K	Ca	Sc	Ti											Ag	Cd	In	Sn	Sb	Te	I	Xe		
37	38	39	40											79	80	81	82	83	84	85	86		
Rb	Sr	Y	Zr											Au	Hg	Tl	Pb	Bi	Po	At	Rn		
55	56	57	72											111	112			114			116		
Cs	Ba	La	Hf																				
87	88	89	104																				
Fr	Ra	Ac	Rf																				

### NAMING CATIONS

For cations, if the charge is always the same (Group A) just write the name of the metal.

Li<sup>+</sup> is called the \_\_\_\_\_.

Sr<sup>2+</sup> is called the \_\_\_\_\_.

Transition metals (as well as tin and lead) can have more than \_\_\_\_\_ type of charge. Indicate the charge with Roman numerals in parenthesis. Zinc (Zn<sup>2+</sup>) and silver (Ag<sup>1+</sup>), although transition metals, only have \_\_\_\_\_ possible charge. Roman numerals ARE NOT used for zinc and \_\_\_\_\_.

Fe<sup>2+</sup> is called the \_\_\_\_\_.

1. Name the following cations.

- a) Ca<sup>2+</sup> \_\_\_\_\_
- b) Al<sup>3+</sup> \_\_\_\_\_
- c) Sn<sup>4+</sup> \_\_\_\_\_
- d) Na<sup>+</sup> \_\_\_\_\_
- e) Fe<sup>3+</sup> \_\_\_\_\_
- f) Cu<sup>+</sup> \_\_\_\_\_

### NAMING ANIONS

Naming monatomic anions is always the same. Change the element ending to – ide.

Examples: F<sup>1-</sup> : F is the symbol for fluorine, F<sup>1-</sup> is called \_\_\_\_\_.

Cl<sup>-</sup> is called \_\_\_\_\_. O<sup>2-</sup> is called the \_\_\_\_\_.

2. Name the following anions.

- a) S<sup>2-</sup> \_\_\_\_\_
- b) Br<sup>1-</sup> \_\_\_\_\_
- c) N<sup>3-</sup> \_\_\_\_\_
- d) Se<sup>2-</sup> \_\_\_\_\_

## NAMING BINARY IONIC COMPOUNDS

In the formula for an ionic compound, the symbol of the cation is written \_\_\_\_\_ that of the anion. Subscripts, or small numbers written to the lower \_\_\_\_\_ of the chemical symbols, show the numbers of ions of each type present in a formula unit. **Binary ionic compounds** are composed of a metal bonded with a \_\_\_\_\_.

- Name the metal ion using a Roman numeral in parenthesis if necessary.
- Follow this name with the name of the nonmetal ion.

3. Name the binary ionic compounds below.

- a) NaCl \_\_\_\_\_
- b)  $\text{Ca}_3\text{P}_2$  \_\_\_\_\_
- c) CuO \_\_\_\_\_
- d)  $\text{SnBr}_2$  \_\_\_\_\_
- e)  $\text{Fe}_2\text{S}_3$  \_\_\_\_\_
- f)  $\text{AlF}_3$  \_\_\_\_\_
- g) KCl \_\_\_\_\_
- h)  $\text{Na}_3\text{N}$  \_\_\_\_\_
- i) CrN \_\_\_\_\_
- j)  $\text{PbO}_2$  \_\_\_\_\_

4. Write the formulas for the following cations.

- a) magnesium ion \_\_\_\_\_
- b) copper (II) ion \_\_\_\_\_
- c) potassium ion \_\_\_\_\_
- d) silver ion \_\_\_\_\_
- e) chromium (VI) ion \_\_\_\_\_
- f) mercury (II) ion \_\_\_\_\_

## WRITING FORMULAS FOR CATIONS

Write the formula for the metal. If a Roman numeral is in parenthesis use that number for the charge. Indicate the charge with a \_\_\_\_\_. If no Roman numeral is given, find the Group A metal on the periodic table and determine the charge from the column number.

The formula for the nickel (II) ion is \_\_\_\_\_.

The formula for the gallium ion is \_\_\_\_\_.

## WRITING FORMULAS FOR ANIONS

Write the formula for the nonmetal. Find the Group A nonmetal on the periodic table and determine the \_\_\_\_\_ from the column number.

The formula for phosphide is \_\_\_\_\_.

The formula for bromide is \_\_\_\_\_.

5. Write the formulas for the following anions.

a) arsenide ion \_\_\_\_\_

b) telluride ion \_\_\_\_\_

c) iodide ion \_\_\_\_\_

d) carbide ion \_\_\_\_\_

### WRITING FORMULAS FOR IONIC COMPOUNDS

Oxidation numbers can be used to determine the chemical formulas for ionic compounds.

If the oxidation number of each ion is \_\_\_\_\_ by the number of that ion present in a formula unit, and then the results are added, the sum must be

\_\_\_\_\_.

- Write the symbol for the metal. Determine the oxidation number from either the column number or the \_\_\_\_\_ numeral and write it as a superscript to the right of the metal's symbol.
- To the right of the metal's symbol, write the symbol for the \_\_\_\_\_. Determine the oxidation number from the column number and write it as a superscript to the right of the nonmetal's symbol.

Example: potassium fluoride -  $K^+$   $F^-$  If the two oxidation numbers add together to get zero, the formula is a one-to-one ratio of the elements. Answer = KF

Example: aluminum sulfide -  $Al^{3+}$   $S^{2-}$  If the two oxidation numbers DO NOT add together to get zero, you will need to " \_\_\_\_\_ " the superscripts. These numbers now become subscripts. **Omit all positive and negative signs and omit all 1's.**

Answer =  $Al_2S_3$

6. Write the formulas for the following binary ionic compounds.

a) lithium selenide \_\_\_\_\_

b) tin (II) oxide \_\_\_\_\_

c) tin (IV) oxide \_\_\_\_\_

d) magnesium fluoride \_\_\_\_\_

e) copper (II) sulfide \_\_\_\_\_

f) iron (II) phosphide \_\_\_\_\_

g) gallium nitride \_\_\_\_\_

h) iron (III) sulfide \_\_\_\_\_

## NAMING TERNARY IONIC COMPOUNDS

Ternary ionic compounds are composed of at least \_\_\_\_\_ elements. Name the metal ion, using a Roman numeral in parenthesis if necessary. Follow this name with the name of the polyatomic ion. Polyatomic ions are groups of atoms that stay together and have a \_\_\_\_\_. Examples are provided on page 7 of the NCDPI Reference Tables for Chemistry. There is one polyatomic ion with a positive oxidation number ( $\text{NH}_4^+$ ) that may come first in a compound. Name the ion, \_\_\_\_\_. Follow this name \_\_\_\_\_ with the name of the \_\_\_\_\_ anion or second polyatomic ion.

7. Name the following ternary ionic compounds.

- a)  $\text{LiCN}$  \_\_\_\_\_
- b)  $\text{Fe}(\text{OH})_3$  \_\_\_\_\_
- c)  $(\text{NH}_4)_2\text{CO}_3$  \_\_\_\_\_
- d)  $\text{NiPO}_4$  \_\_\_\_\_
- e)  $\text{NaNO}_3$  \_\_\_\_\_
- f)  $\text{CaSO}_4$  \_\_\_\_\_
- g)  $(\text{NH}_4)_2\text{O}$  \_\_\_\_\_
- h)  $\text{CuSO}_3$  \_\_\_\_\_

## WRITING FORMULAS FOR TERNARY IONIC COMPOUNDS

Write the symbol for the metal or ammonium ion. Write the \_\_\_\_\_ number as a superscript to the right of the metal's/ammonium ion's symbol. To the right of the metal's symbol, write the symbol for the nonmetal or polyatomic ion. Write the oxidation number as a superscript to the \_\_\_\_\_ of the nonmetal's/polyatomic ion's symbol.

- Example: potassium nitrate -  $\text{K}^+ \text{NO}_3^-$  If the two oxidation numbers add together to get \_\_\_\_\_, the formula is a one-to-one ratio of the elements. Answer =  $\text{KNO}_3$
- Example: aluminum hydrogen sulfate –  $\text{Al}^{3+} \text{HSO}_4^-$  If the two oxidation numbers DO NOT add together to get zero, you will need to “criss-cross” the superscripts. These numbers now become subscripts. Parentheses are to be placed around polyatomic ions before criss-crossing. Omit all positive and \_\_\_\_\_ signs and omit all 1's. Answer =  $\text{Al}(\text{HSO}_4)_3$

8. Write the formulas for the following ternary ionic compounds.

- a) ammonium chloride \_\_\_\_\_ b) ammonium sulfide \_\_\_\_\_  
c) barium nitrate \_\_\_\_\_ d) zinc iodate \_\_\_\_\_  
e) sodium hypochlorite \_\_\_\_\_ f) chromium (III) acetate \_\_\_\_\_  
g) iron (II) dichromate \_\_\_\_\_ h) mercury (I) bromate \_\_\_\_\_

### NAMING COVALENT (MOLECULAR) COMPOUNDS

Molecular compounds are made of molecules. They are made by joining \_\_\_\_\_ atoms together into molecules. A molecular compound's name tells you the number of atoms through the use of \_\_\_\_\_.

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

The name will consist of \_\_\_\_\_ words. Prefix name prefix name -ide One exception is we don't write mono- if there is only one of the first element. The following double vowels cannot be used when writing names: (oa) and (oo).

- Example:  $\text{NO}_2$  There is one nitrogen. Mononitrogen But, you cannot use mono- on the first element, so \_\_\_\_\_ the prefix. There are two oxygens. dioxygen You need the suffix -ide. dioxide  
Answer: nitrogen dioxide.
- Example:  $\text{N}_2\text{O}$  There are two nitrogens. Dinitrogen There is one oxygen. monooxygen You cannot run (oo) together, so monooxygen. You need the suffix -ide. monoxide Answer: dinitrogen monoxide.

9. Name the following molecular compounds.

- a)  $\text{Cl}_2\text{O}_7$  \_\_\_\_\_ b)  $\text{CBr}_4$  \_\_\_\_\_  
c)  $\text{CO}_2$  \_\_\_\_\_ d)  $\text{BCl}_3$  \_\_\_\_\_

### WRITING FORMULAS FOR MOLECULAR COMPOUNDS

When writing a formula of a molecular compound from the name, you will not need to criss-cross oxidation numbers. Molecular compounds name tells you the number of atoms through the use of \_\_\_\_\_.

- Example: diphosphorus pentoxide The name implies there are 2 phosphorous atoms and 5 oxygens. Answer:  $P_2O_5$
- Example: sulfur hexafluoride The name implies there is 1 sulfur atom and 6 fluorines. Answer:  $SF_6$

10. Write the formulas for the following molecules.

- a) tetraiodine nonoxide \_\_\_\_\_ b) nitrogen trioxide \_\_\_\_\_  
 c) carbon tetrahydride \_\_\_\_\_ d) phosphorus trifluoride \_\_\_\_\_

	<b>IONIC</b>	<b>MOLECULAR</b>
Smallest Piece		molecule
Types of Elements	metal and nonmetal	
State of Matter	Solid	
Melting Point		Low <300°C

### ACIDS

Acids are compounds that give off \_\_\_\_\_ ions ( $H^+$ ) when dissolved in water. Acids will always contain one or more hydrogen ions next to an anion. The \_\_\_\_\_ determines the name of the acid.

- Example:  $HCl$  The acid contains the hydrogen ion and chloride ion. Begin with the prefix hydro-, name the nonmetallic ion and change -ide to -ic acid. Answer: hydrochloric acid
- Example:  $H_2S$  The acid contains the hydrogen ion and sulfide ion. Begin with the prefix hydro- and name the nonmetallic ion. The next step is change -ide to -ic acid, but for sulfur the "ur" is added before -ic. Answer: hydrosulfuric acid

11. Name the following binary acids.

a) HF \_\_\_\_\_

b) H<sub>3</sub>P \_\_\_\_\_

### WRITING FORMULAS FOR BINARY ACIDS

The prefix hydro- lets you know the acid is binary. Determine whether you need to criss-cross the oxidation numbers of hydrogen and the nonmetal.

- Example: hydrobromic acid The acid contains the hydrogen ion and the bromide ion.  $H^{1+} Br^{1-}$  The two oxidation numbers add together to get zero. Answer: HBr
- Example: hydrotelluric acid The acid contains the hydrogen ion and the telluride ion.  $H^{1+} Te^{2-}$  The two oxidation numbers do NOT add together to get zero, so you must criss-cross. Answer: H<sub>2</sub>Te

12. Write

### NAMING TERNARY ACIDS

a) The acid is a ternary acid if the anion has \_\_\_\_\_ in it. The anion ends in -ate or -ite. Change the suffix -ate to -\_\_\_\_ acid. Change the suffix -ite to -ous acid. The hydro- prefix is NOT used!

➤ Example: HNO<sub>2</sub> The acid contains the hydrogen ion and nitrite ion. Name the polyatomic ion and change -ite to -ous acid. Answer: nitrous acid

➤ Example: H<sub>3</sub>PO<sub>4</sub> The acid contains the hydrogen ion and phosphate ion. Name the polyatomic ion and change -ate to -ic acid.

Answer: phosphoric acid

13. Name the following ternary acids.

- a)  $\text{H}_2\text{CO}_3$  \_\_\_\_\_ b)  $\text{H}_2\text{SO}_4$  \_\_\_\_\_  
c)  $\text{H}_2\text{CrO}_4$  \_\_\_\_\_ d)  $\text{HClO}_2$  \_\_\_\_\_

### WRITING FORMULAS FOR TERNARY ACIDS

The lack of the prefix hydro- from the name implies the acid is ternary, made of the hydrogen ion and a \_\_\_\_\_ polyatomic ion. Determine whether you need to criss-cross the oxidation numbers of hydrogen and the polyatomic ion.

- Example: acetic acid The polyatomic ion must end in -ate since the acid ends in -ic. The acid is made of  $\text{H}^+$  and the acetate ion.  $\text{H}^{1+} \text{C}_2\text{H}_3\text{O}_2^{1-}$  The two charges when added equal zero. Answer:  $\text{HC}_2\text{H}_3\text{O}_2$
- Example: sulfurous acid Again the lack of the prefix hydro- implies the acid is ternary, made of the hydrogen ion and a polyatomic ion. The polyatomic ion \_\_\_\_\_ must end in -ite since the acid ends in -ous. The acid is made of  $\text{H}^+$  \_\_\_\_\_

14. Write the formulas for the following binary acids.

- a) perchloric acid \_\_\_\_\_ b) iodic acid \_\_\_\_\_  
c) dichromic acid \_\_\_\_\_ d) hypochlorous acid \_\_\_\_\_