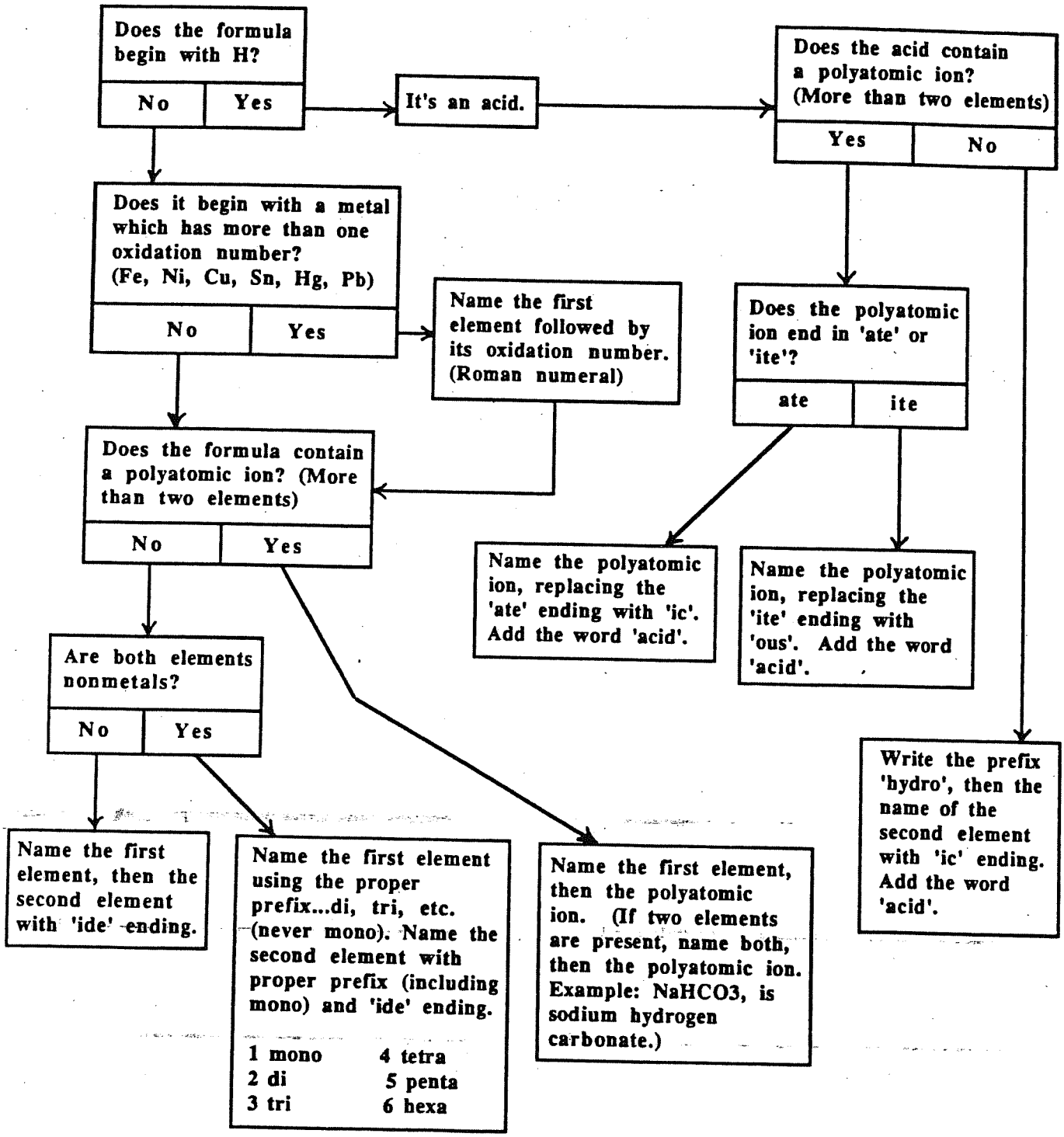
NAMING COMPOUNDS FLOW CHART



Chemistry: Form WS4.2.3A Name _____

BONDING Date _____ Period _____

Using the Stock System

The **stock system** is a set of rules for naming compounds of metals and non metals. The metal always comes first in the name and the formula. Monatomic metal ions, those consisting of only one type of atom, come in two varieties – univalent and polyvalent. For univalent metal ions, those having only one oxidation state, the name of the ion is exactly the same as that of the element that formed it. As a result, both Na and Na^+ are called sodium. For polyvalent metal ions, those having multiple oxidation states, a roman numeral indicates the oxidation state. As a result, Fe^{+2} is called iron II, while Fe^{+3} is called iron III. Polyatomic metal ions, those consisting of more than one type of element such as NH_4^+, ammonium, are found on *Table E*.

The nonmetal always comes last in the name and in the formula. For monatomic nonmetal ions, delete the last part of the elements name and add "IDE". Thus the element sulfur (S) forms the ion sulfIDE (S^{-2}). Polyatomic nonmetal ions, such as SO_4^{-2} (sulfate) or OH^- (hydroxide) are found on *Table E*.

To write the name from the formula, it is necessary to first check the *Periodic Table* to see if the metal is polyvalent. If it is, you need to figure out the oxidation state of the metal by checking to see which one will make the sum of the oxidation states in the compound add up to zero. To write the formulas from the name, you need to look up the oxidation states of the ions, and apply the crossover rule.

Using the rules above, write the names for the compounds listed below on the left and the formulas for the compounds listed below on the right.

Writing Names		Writing Formulas	
1. NaCl	_____	11. iron III oxide	_____
2. $CuSO_4$	_____	12. chromium III carbonate	_____
3. $(NH_4)_2S$	_____	13. calcium sulfide	_____
4. BaO	_____	14. lead II arsenide	_____
5. LiF	_____	15. ammonium nitrate	_____
6. $Sn(NO_3)_4$	_____	16. potassium oxalate	_____
7. K_3N	_____	17. aluminum acetate	_____
8. $HgBr_2$	_____	18. cesium thiosulfate	_____
9. CaI_2	_____	19. strontium phosphide	_____
10. $Mg_3(PO_4)_2$	_____	20. tin IV oxide	_____

WRITING FORMULAS (CRISS-CROSS METHOD)

Name _____

Write the formulas of the compounds produced from the listed ions.

	Cl^-	CO_3^{-2}	OH^-	SO_4^{-2}	PO_4^{-3}	NO_3^-
Na^+						
NH_4^+						
K^+						
Ca^{+2}						
Mg^{+2}						
Zn^{+2}						
Fe^{+3}						
Al^{+3}						
Co^{+3}						
Fe^{+2}						
H^+						

NAMING IONIC COMPOUNDS

Name _____

Name the following compounds using the Stock Naming System.

1. $CaCO_3$ _____
2. KCl _____
3. $FeSO_4$ _____
4. $LiBr$ _____
5. $MgCl_2$ _____
6. $FeCl_3$ _____
7. $Zn_3(PO_4)_2$ _____
8. NH_4NO_3 _____
9. $Al(OH)_3$ _____
10. $CuC_2H_3O_2$ _____
11. $PbSO_3$ _____
12. $NaClO_3$ _____
13. CaC_2O_4 _____
14. Fe_2O_3 _____
15. $(NH_4)_3PO_4$ _____
16. $NaHSO_4$ _____
17. Hg_2Cl_2 _____
18. $Mg(NO_2)_2$ _____
19. $CuSO_4$ _____
20. $NaHCO_3$ _____
21. $NiBr_3$ _____
22. $Be(NO_3)_2$ _____
23. $ZnSO_4$ _____
24. $AuCl_3$ _____
25. $KMnO_4$ _____

WRITING FORMULAS FROM NAMES

Name _____

Write the formulas of the following compounds.

1. ammonium phosphate _____
2. iron (II) oxide _____
3. iron (III) oxide _____
4. carbon monoxide _____
5. calcium chloride _____
6. potassium nitrate _____
7. magnesium hydroxide _____
8. aluminum sulfate _____
9. copper (II) sulfate _____
10. lead (IV) chromate _____
11. diphosphorus pentoxide _____
12. potassium permanganate _____
13. sodium hydrogen carbonate _____
14. zinc nitrate _____
15. aluminum sulfite _____

Name _____ Class_____ Date_____

Activity 3-3
Practice Drill: Formulas and Names

Write the name for each of the following compounds. Use the Stock system where appropriate.

1. $CaCO_3$ _____
2. FeO _____
3. H_2CO_3 _____
4. $AgCl$ _____
5. $Ca_3(PO_4)_2$ _____
6. $Ba(OH)_2$ _____
7. Na_2S _____
8. $FeCl_2$ _____
9. H_2CrO_4 _____
10. $(NH_4)_2SO_4$ _____
11. H_2SO_4 _____
12. $Zn(NO_3)_2$ _____
13. $CuSO_4$ _____
14. $AlCl_3$ _____
15. $NaOH$ _____
16. $PbCl_2$ _____
17. KNO_3 _____
18. $Mg(OH)_2$ _____
19. $HClO_3$ _____
20. $H_2C_2O_4$ _____

Write the chemical formula for each of the following compounds.

21. sodium nitrite _____
22. iron (III) oxide _____
23. aluminum hydroxide _____
24. ammonium hydroxide _____
25. magnesium chloride _____
26. hydrochloric acid _____
27. cuprous oxide _____
28. potassium sulfate _____
29. zinc oxide _____
30. barium sulfite _____
31. potassium carbonate _____
32. silver sulfide _____
33. nitrous acid _____
34. calcium phosphate _____
35. copper (II) nitrate _____
36. magnesium sulfide _____
37. aluminum oxide _____
38. barium nitride _____
39. lead (II) sulfate _____
40. hypochlorous acid _____

Write the name for each of the following compounds. Use the Stock system where appropriate.

41. NH_4NO_2 _____
42. $Ca(HCO_3)_2$ _____
43. $Ba(ClO_3)_2$ _____
44. Hg_2I_2 _____
45. KCN _____
46. PbO_2 _____
47. $KSCN$ _____
48. $Zn(C_2H_3O_2)_2$ _____
49. K_2SO_4 _____
50. $Hg(OH)_2$ _____
51. K_2SO_3 _____
52. Cu_2S _____
53. $KHSO_4$ _____
54. $ZnBr_2$ _____
55. $Fe_2(CrO_4)_3$ _____
56. $NaClO_4$ _____
57. $KClO$ _____
58. Mg_3N_2 _____
59. Na_2MnO_4 _____
60. $KMnO_4$ _____

Write the chemical formula for each of the following compounds.

61. mercury (I) cyanide _____
62. hydrosulfuric acid _____
63. iron (II) acetate _____
64. potassium chlorate _____
65. lead (II) fluoride _____
66. hydrobromic acid _____
67. ammonium oxalate _____
68. mercury (II) chromate _____
69. silver phosphate _____
70. potassium dichromate _____
71. barium nitride _____
72. sodium peroxide _____
73. cupric bromide _____
74. ammonium sulfide _____
75. calcium nitrate _____
76. zinc hydroxide _____
77. sodium hydrogen carbonate _____
78. lead (IV) oxide _____
79. potassium perchlorate _____
80. mercurous iodide _____

NAMING MOLECULAR COMPOUNDS

Name _____

Name the following covalent compounds.

1. CO_2 _____
2. CO _____
3. SO_2 _____
4. SO_3 _____
5. N_2O _____
6. NO _____
7. N_2O_3 _____
8. NO_2 _____
9. N_2O_4 _____
10. N_2O_5 _____
11. PCl_3 _____
12. PCl_5 _____
13. NH_3 _____
14. SCl_6 _____
15. P_2O_5 _____
16. CCl_4 _____
17. SiO_2 _____
18. CS_2 _____
19. OF_2 _____
20. PBr_3 _____

Chemistry: Form WS4.2.2A Name _____

BONDING Date _____ Period _____

Determining the Charge on a Metal Ion

Univalent metal ions, those with only one oxidation state, are named exactly the same as the element (Ba is named barium, and Ba^{+2} is also named barium), but polyvalent metal ions, those with multiple oxidation states, include a roman numeral in the name to indicate the oxidation state (Cu^{+1} is called copper I, while Cu^{+2} is called copper II). In order to name a compound, therefore, it is necessary to check on the *Periodic Table* to see if the metal ion has more than one oxidation state. If it does, it is necessary to figure out what the oxidation state is so the correct roman numeral can be included as part of the name. This can be done as in the following example based on the formula $Fe_2(S_2O_3)_3$.

$Fe_2(S_2O_3)_3$

ion	Fe	S_2O_3	
subscript	2	3	
oxidation state	+3	–2	*TOTAL*
total	+6	–6	= 0

STEP 1 (subscript row) STEP 2 (oxidation state row) STEP 3 (–6) STEP 4 (+6) STEP 5 (oxidation state row)

Prepare a table as above.

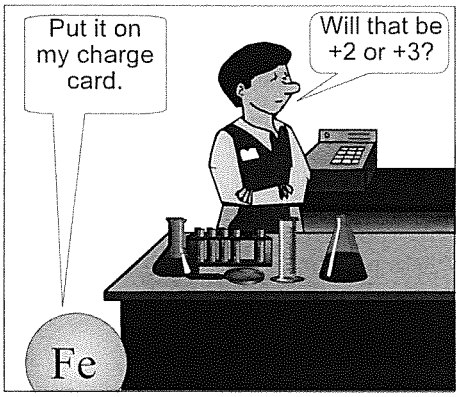
Step 1: List the subscripts for the metal and the nonmetal ions.

Step 2: Look up the oxidation state of the nonmetal ion on the *Periodic Table*.

Step 3: Multiply the oxidation state of the nonmetal by its subscript to get the total charge.

Step 4: Determine the total charge of the metal ions by calculating the number which, when added to the total charge of the nonmetal ion, gives the compound a total charge of zero.

Step 5: Divide the total charge of the metal ions by the subscript of the metal to get the oxidation state.



When ions go shopping

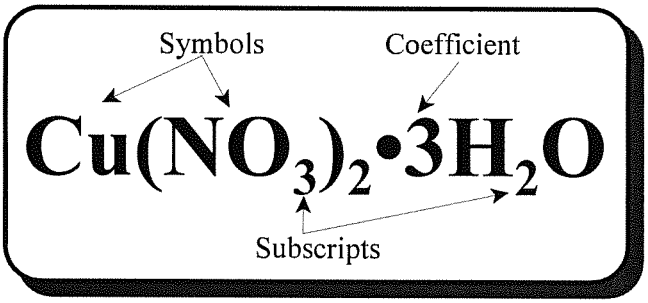
Using the procedures described above and to the left, determine the oxidation states of the metals in each of the compounds listed below.

1. $BaCl_2$ . . . . . _____
2. PbO_2 . . . . . _____
3. $MnCl_7$ . . . . . _____
4. $Cr_3(PO_4)_2$ . . . _____
5. $Al_2(SO_4)_3$ . . . _____
6. Sn_3P_4 . . . . . _____
7. $Ca(NO_3)_2$ . . . _____
8. Cu_2S . . . . . _____
9. FeO . . . . . _____
10. $Fe_2(SO_4)_3$ . . . _____

Chemistry: Form WS4.2.0A Name _____

BONDING Date _____ Period _____

Interpreting Chemical Formulas



A chemical formula consists of chemical symbols, subscripts, and, in some cases, a coefficient. The chemical symbols show which elements are present in the compound. Subscripts are small numbers written to the lower right of the symbol to which they refer. In the formula to the right, there are three atoms of oxygen in each nitrate ion (NO_3^-) and two atoms of hydrogen in each molecule of water (H_2O). There is only one atom of copper, but a subscript of one (1) is never written. It is understood. Nitrate is a polyatomic ion. When there is more than one polyatomic ion, it is enclosed in parentheses, and the subscript is written outside to the lower right referring to everything inside. As a result, $Cu(NO_3)_2$ has two nitrogen and six oxygen atoms. Some materials such as copper II nitrate crystallize in such a way that they are attached to a fixed number of water molecules. These are called hydrated crystals. The number of molecules or formula units is shown by a large number called a coefficient. The coefficient is written to the left of the formula, and multiplies everything to the right of it. This means the formula above has a total of 6 hydrogen atoms. The formulas for the copper II nitrate and the water are separated by a dot. The number of atoms in the formula above is 18, because it shows 1 atom of copper, 2 atoms of nitrogen, 9 atoms of oxygen (6 from the nitrate plus 3 from the water), and 6 atoms of hydrogen.

For each of the formulas below, determine the number and type of each of the atoms shown, and the total number of atoms.

Example

$5(NH_4)_3PO_4$ ..... N = 15, H = 60, P = 5, O = 20, *TOTAL* = 100

1. $4NaHCO_3$ ..... _____
2. $15HCl$ ..... _____
3. $3Al_2O_3$ ..... _____
4. $6KNO_3$ ..... _____
5. $2N_2O_5$ ..... _____
6. $7Sn(NO_2)_4$ ..... _____
7. $4Mn_2(Cr_2O_7)_7$ ..... _____
8. $9Na_2SO_3$ ..... _____
9. $8Ba_3(PO_4)_2$ ..... _____
10. $5MgSO_4 \cdot 7H_2O$ ..... _____