Nomenclature and Formula Writing

Ionic Compounds (metal + nonmetal)

Binary Compounds (two elements only)

- write the name of the metal (positively charged)
- then write the name of the nonmetal using the ide ending.

ex. METAL NONMETAL STEM + IDE
NaCl sodium chloride
$MgBr_2$ magnesium bromide

Compounds with Polyatomic Ions

- write the name of the metal or positively charged ion
- write the name of the complex ion

ex. METAL COMPLEX ION
$CaSO_4$ calcium sulfate
$NaHCO_3$ sodium bicarbonate
or sodium hydrogen carbonate

Multivalent Metals - Compounds where the metal has more than one oxidation number

- write the name of the metal
- write the oxidation number using roman numerals in parentheses
  - or write the name with the "ic" (higher oxidation #) or "ous" (lower oxidation #) ending. Some metals use their Latin names with these endings.
- write the nonmetal or the complex ion

ex. Cu_2O copper(I) oxide or cuprous oxide CuO copper(II) oxide or cupric oxide

cupric	Cu^{2+}	ferric	Fe^{3+}	auric	Au^{3+}	plumbic	Pb^{4+}	stannic	Sn^{4+}	mercuric	Hg^{2+}
cuprous	Cu^{+}	ferrous	Fe^{2+}	aurous	Au^{+}	plumbous	Pb^{2+}	stannous	Sn^{2+}	mercurous	Hg^{+}

Molecular Compounds (Covalent Compounds) (nonmetal + nonmetal)

- because nonmetals combine in more than one ratio, we must use prefixes to indicate the number of atoms of each element in the formula.
- the following prefixes are used:
- if the prefix is followed by a vowel, the final "a" or "o" is dropped
- exception: the prefix mono is omitted for the first element only.

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

ex. N_2O dinitrogen monoxide N_2O_5 dinitrogen pentoxide CO carbon monoxide CO_2 carbon dioxide

Hydrates - Ionic Compounds

There are many compounds that crystallize from a water solution with water molecules adhering to the particles of the crystal. These hydrates, as they are called, usually contain a specific ratio of water to compound. Chemists use heat to dry these compounds and then calculate the ratio of compound to water. An example of a hydrate is $NiSO_3 \bullet 6H_2O$. The dot shows that 6 molecules of water adhere to 1 formula unit. To name the compound, name the portion preceding the dot, followed by the prefix for the number and hydrate. The above compound would be named: $NiSO_3 \bullet 6H_2O$ nickel(II) sulfite hexahydrate

Acids

Acids are a group of compounds that are given special treatment in naming. Acids are defined in several ways, but in general, we can say that acids are compounds that give off hydrogen in water. The formula of an acid is one or more hydrogens bonded to a monatomic or polyatomic anion. The way that the acid is named is determined by the suffix of the anion.

hydrogen _____ide	becomes	hydro_____ic acid
hydrogen _____ate	becomes	_____ic acid
hydrogen _____ite	becomes	_____ous acid

examples:

HCl	hydrogen chlor**ide**	becomes	**hydro**chlor**ic** acid
$HClO_4$	hydrogen perchlor**ate**	becomes	perchlor**ic** acid
$HClO_3$	hydrogen chlor**ate**	becomes	chlor**ic** acid
$HClO_2$	hydrogen chlor**ite**	becomes	chlor**ous** acid
$HClO$	hydrogen hypochlor**ite**	becomes	hypochlor**ous** acid

1. Binary Ionic Compounds. Give the correct names for each of the compounds listed below.

a) $NaCl$ _____

b) $FrBr$ _____

c) KF _____

d) RaS _____

e) LiI _____

f) Li_3N _____

g) $AlBr_3$ _____

h) $CdCl_2$ _____

i) K_2O _____

j) InF_3 _____

k) ZnO _____

l) Y_2O_3 _____

m) $CaTe$ _____

n) ZrS_2 _____

o) AgI _____

p) $BaSe$ _____

q) MgO _____

r) $LaBr_3$ _____

s) Sr_3N_2 _____

t) Cd_3As_2 _____

u) Rb_2Se _____

v) Rb_3N _____

w) BaF_2 _____

x) $ZrTe_2$ _____

y) Cs_3P _____

z) Y_2O_3 _____

2. Binary Ionic Compounds. Write the correct chemical formula for each of the following compounds.

a) potassium bromide _____

b) zinc bromide _____

c) lithium iodide _____

d) scandium chloride _____

e) magnesium chloride _____

f) magnesium oxide _____

g) hydrogen sulfide _____

h) gallium iodide _____

i) sodium oxide _____

j) magnesium selenide _____

k) calcium fluoride _____

l) aluminum oxide _____

m) beryllium chloride _____

n) potassium nitride _____

o) aluminum bromide _____

p) zinc phosphide _____

q) magnesium sulfide _____

r) hafnium chloride _____

s) barium sulfide _____

t) tantalum oxide _____

u) zirconium nitride _____

v) potassium selenide _____

w) germanium fluoride _____

x) francium phosphide _____

y) zinc arsenide _____

z) scandium telluride _____

3. Polyatomic Ions. Give the correct names for each of the compounds listed below.

a) $CaSO_4$ _____

b) $Ca_3(AsO_4)_2$ _____

c) NH_4Cl _____

d) $Mg_3(AsO_3)_2$ _____

e) $NaC_2H_3O_2$ _____

f) $NaOCN$ _____

g) $Al_2(SO_4)_3$ _____

h) $K_2Cr_2O_7$ _____

i) NH_4NO_3 _____

j) $KSCN$ _____

k) $Al(OH)_3$ _____

l) MgS_2O_8 _____

m) $NaHCO_3$ _____

n) $Ta(IO_3)_5$ _____

o) $(NH_4)_3PO_4$ _____

p) $AgClO$ _____

q) KOH _____

r) $NaC_8H_{11}N_2O_3$ _____

s) HNO_3 _____

t) $In(VO_3)_3$ _____

u) Na_2HPO_3 _____

v) $Ta_2(TeO_4)_5$ _____

w) $Ca(NO)_2$ _____

x) $Zn(VO_3)_2$ _____

y) $Ba(OH)_2$ _____

z) $CaC_8H_4O_4$ _____

4. Polyatomic Ions. Write the correct chemical formula for each of the following compounds.

a) sodium acetate _____

b) aluminum tetraborate _____

c) calcium bromate _____

d) sodium silicate _____

e) magnesium citrate _____

f) calcium tungstate _____

g) potassium cyanide _____

h) zinc phthalate _____

i) barium carbonate _____

j) indium stearate _____

k) calcium dichromate _____

l) yttrium tripolyphosphite _____

m) zirconium bicarbonate _____

n) silver fluorite _____

o) scandium hydroxide _____

p) aluminum citrate _____

q) hafnium nitrate _____

r) francium hydrogen oxalate _____

s) rubidium permanganate _____

t) gallium sulfite _____

u) ammonium dichromate _____

v) cesium hypochlorite _____

w) sodium phosphite _____

x) sodium dihydrogen phosphate _____

y) sodium hydrogen phosphate _____

z) zirconium uranate _____

5. Multivalent Metals. Give the correct names for each of the compounds listed below.

a) FeI_3 _____

b) $Bi_2(SO_4)_3$ _____

c) FeI_2 _____

d) $HgHCO_3$ _____

e) NiO _____

f) $Pb(H_2PO_3)_2$ _____

g) $CuBr_2$ _____

h) $Pt(CrO_4)_2$ _____

i) Cr_2O_3 _____

j) $Sb_2(SO_5)_3$ _____

k) $AuCl_3$ _____

l) $Np(MnO_3)_5$ _____

m) WO_3 _____

n) $PuPO_4$ _____

o) PdI_4 _____

p) OsS_2 _____

q) Co_2S_3 _____

r) Ti_3N_4 _____

s) MnO_2 _____

t) $NiSO_4$ _____

u) $Ti(Cr_2O_7)_2$ _____

v) $FeSO_3$ _____

w) $Os(NO_3)_4$ _____

x) $Hg(NO_2)_2$ _____

y) $SnSO_4$ _____

z) $AuCl_3$ _____

6. Multivalent Metals. Write the correct chemical formula for each of the following compounds.

a) lead(IV) oxide _____

b) antimony(V) bromite _____

c) cobalt(II) fluoride _____

d) ferric thiosulfate _____

e) copper(II) cyanide _____

f) stannic tartrate _____

g) copper(I) nitride _____

h) platinum(IV) dichromate _____

i) nickel(II) acetate _____

j) tin(II) peroxydisulfate _____

k) gallium(III) acetate _____

l) gold(III) uranate _____

m) osmium(IV) sulfate _____

n) polonium(IV) sulfide _____

o) vanadium(V) iodate _____

p) plumbic phosphate _____

q) molybdenum(VI) benzoate_____

r) niobium(V) oxide _____

s) aurous silicate _____

t) titanium(IV) sulfite _____

u) cobaltous chloride _____

v) samarium(III) nitrite _____

w) plumbic hydroxide _____

x) terbium (IV) periodate _____

y) iridium(IV) periodate _____

z) stannous bicarbonate _____

7. Molecular Compounds. Give the correct names for each of the compounds listed below.

a) CS_2 _____

b) SF_2 _____

c) CO _____

d) ICl_3 _____

e) CCl_4 _____

f) As_2O_3 _____

g) PBr_3 _____

h) IF_5 _____

i) PBr_5 _____

j) N_2O_4 _____

k) SO_3 _____

l) SO_2 _____

m) N_2O_3 _____

n) Cl_2O _____

o) SF_6 _____

p) SiO_2 _____

8. Molecular Compounds. Write the correct chemical formula for each of the following compounds.

a) nitrogen monoxide _____

b) carbon dioxide _____

c) iodine monochloride _____

d) sulfur trioxide _____

e) chlorine trifluoride _____

f) phosphorus pentachloride _____

g) bromine pentafluoride _____

h) carbon tetrachloride _____

i) dinitrogen tetroxide _____

j) diphosphorus trisulfide _____

k) chlorine dioxide _____

l) silicon disulfide _____

m) silicon tetrafluoride _____

n) sulfur dioxide _____

o) tricarbon disulfide _____

p) dinitrogen pentoxide _____

9. Hydrates. Give the correct names for each of the compounds listed below.

a) $Li_2SiF_6 \bullet 2H_2O$ _____

b) $Na_2B_4O_7 \bullet 10H_2O$ _____

c) $MgSO_3 \bullet 6H_2O$ _____

d) $NaC_2H_3O_2 \bullet 3H_2O$ _____

e) $CuSO_4 \bullet 5H_2O$ _____

f) $MgSO_4 \bullet 9H_2O$ _____

g) $CaSO_4 \bullet 2H_2O$ _____

h) $MgCl2 \bullet 6H2O$ _____

i) $FeSO_4 \bullet 7H_2O$ _____

j) $NaHS \bullet H2O$ _____

10. Hydrates. Write the correct chemical formula for each of the following compounds.

a) calcium chloride hexahydrate _____

b) barium chloride dihydrate _____

c) calcium nitrate tetrahydrate _____

d) sodium chromate tetrahydrate _____

e) copper(II) nitrate trihydrate _____

f) plumbous acetate trihydrate _____

g) aluminum chloride hexahydrate _____

h) sodium dihydrogen phosphate nonahydrate_____

i) cobalt(II) nitrate hexahydrate _____

j) cobaltous sulfate hexahydrate _____

11. Acids. Give the correct formula for each of the compounds listed below.

a) hydrochloric acid _____

b) citric acid _____

c) benzoic acid _____

d) acetic acid _____

e) periodic acid _____

f) lactic acid _____

g) formic acid _____

h) iodic acid _____

i) oxalic acid _____

j) sulfurous acid _____

k) sulfuric acid _____

l) carbonic acid _____

m) phosphorous acid _____

n) hydroiodic acid _____

o) phosphoric acid _____

p) nitrous acid _____

q) thiosulfurous acid _____

r) nitric acid _____

s) hydrotelleric acid _____

t) hydrocyanic acid _____

u) hydroselenic acid _____

v) nitrous acid _____

w) hypooxalous acid _____

x) hydrofluoric acid _____

y) boric acid _____

z) hydrosulfuric acid _____

12. Acids. Write the correct name for each of the following compounds.

a) $HC_2H_3O_2(aq)$ _____

b) $H_2B_4O_7(aq)$ _____

c) $H_3AsO_3(aq)$ _____

d) $HI(aq)$ _____

e) $H_3BO_3(aq)$ _____

f) $HF(aq)$ _____

g) $HCNO(aq)$ _____

h) $H_2SO_4(aq)$ _____

i) $H_2C_4H_4O_6(aq)$ _____

j) $HCN(aq)$ _____

k) $H(HCOO)(aq)$ _____

l) $HNO_3(aq)$ _____

m) $HC_5H_8NO_4(aq)$ _____

n) $H_3PO_4(aq)$ _____

o) $HClO(aq)$ _____

p) $HBr(aq)$ _____

q) $H_2C_2O_4(aq)$ _____

r) $H_2CO_3(aq)$ _____

s) $H_2SiO_2(aq)$ _____

t) $HFO_2(aq)$ _____

u) $HC_{17}H_{35}COO(aq)$ _____

v) $H_3PO_3(aq)$ _____

w) $HCl(aq)$ _____

x) $HBrO_2(aq)$ _____

A. Review. Give the correct chemical formula for each of the following compounds.

1. sodium hydroxide _____
2. copper(II) sulfide _____
3. potassium phosphide _____
4. ozone _____
5. lithium nitride _____
6. lithium hydride _____
7. magnesium percarbonate _____
8. aluminum sulfite _____
9. sodium sulfate heptahydrate _____
10. sodium carbonite _____
11. perchloric acid _____
12. calcium hyponitrite _____
13. nitrous acid _____
14. sulfurous acid _____
15. zinc acetate trihydrate _____
16. potassium hypochromite _____
17. barium nitride _____
18. cobalt(II) perphosphate _____
19. carbon dioxide _____
20. sulfuric acid _____
21. iron(III) chloride _____
22. chromium(III) acetate _____
23. hydrobromic acid _____
24. silver carbonate _____
25. hydrogen bromide _____
26. barium chloride _____
27. boron trifluoride _____
28. calcium hydroxide _____
29. calcium hydride _____
30. lead(II) hyposulfite _____
31. hypophosphorous acid _____
32. carbonic acid _____
33. beryllium perchlorate _____
34. ferrous hydroxide _____
35. nickel(II) peracetate _____
36. mercuric chloride dihydrate _____
37. dinitrogen trioxide _____
38. sodium hypoiodite _____
39. potassium cyanide _____
40. potassium aluminum sulfate _____
41. ammonium hypophosphite _____
42. potassium uranate _____
43. lithium peroxide _____
44. perchloric acid _____
45. ammonia _____
46. iodous acid _____
47. hydrogen peroxide _____
48. gold(III) periodate _____
49. sodium oxide _____
50. sodium glutamate _____
51. iron(II) sulfate _____
52. barium perchlorate _____
53. manganese(II) nitrate _____
54. osmium(IV) thiosulfate _____
55. chromium(III) nitrate _____
56. boric acid _____
57. rubidium acetate _____
58. hypoiodous acid _____
59. cerium(III) phosphate _____
60. nitrous acid _____
61. chromium(III) nitride _____
62. nitric acid _____
63. magnesium nitrate _____
64. hypoiodous acid _____
65. copper(II) tartrate _____
66. arsenous acid _____
67. magnesium hexafluorosilicate _____
68. cyanic acid _____

B. Review. Give the correct names for each of the compounds listed below.

1. SnO_2 _____
2. Sb_2S_3 _____
3. HgS _____
4. MoS_2 _____
5. FeS _____
6. HgO _____
7. $AuCl_3$ _____
8. $NiBr_2$ _____
9. MgO _____
10. $NaBr$ _____
11. Al_2O_3 _____
12. CaO _____
13. Ag_2S _____
14. CaH_2 _____
15. K_2CO_3 _____
16. $(NH_4)_2S$ _____
17. $Cr(NO_3)_2$ _____
18. $KMnO_4$ _____
19. SO_3 _____
20. P_2S_5 _____
21. As_2S_3 _____
22. CCl_4 _____
23. N_2O_4 _____
24. NO _____
25. H_3BO_3 _____
26. $MgSCN$ _____
27. HNO_2 _____
28. As_2S_5 _____
29. H_3PO_4 _____
30. $Fe(NO_3)_2$ _____
31. H_3AsO_3 _____
32. Cu_2SO_4 _____
33. HIO_3 _____
34. $K_2C_2O_4$ _____
35. Na_3PO_4 _____
36. Na_2CrO_4 _____
37. $LiClO_4$ _____
38. $Zn(C_2H_3O)_2$ _____
39. $Au(CN)_3$ _____
40. K_2CrO_4 _____
41. $KHCO_3$ _____
42. $Mn(OH)_2$ _____
43. $Ba(SCN)_2$ _____
44. $RbCN$ _____
45. $NaBrO$ _____
46. $Al_2(SO_5)_3$ _____
47. $Fe(ClO)_2$ _____
48. $(NH_4)_2CO_3$ _____
49. $Zn(NO_2)_2$ _____
50. $Ca(NO_3)_2$ _____
51. NH_4OH _____
52. $NiPO_2$ _____
53. NH_3 _____
54. $CaSO_4$ _____
55. $Pb(HSO_4)_4$ _____
56. $Ca(ClO_3)_2$ _____
57. $AlPO_4$ _____
58. Li_2CO_2 _____
59. PCl_5 _____
60. $Mg(NO_3)_2$ _____
61. SO_2 _____
62. $BaCr_2O_7$ _____
63. SrH_2 _____
64. H_2SO_4 _____
65. Na_2O_2 _____
66. CsH_2PO_4 _____
67. $Pb_3(PO_3)_2$ _____
68. $HBr(aq)$ _____