NOMENCLATURE PRE-LABORATORY EXERCISE
You must read the lab before completing this prelab

1. When the following elements form ionic compounds, they have only one fixed charge. What charge do each of the following elements have in an ionic compound?

Element	Charge
Mg	
K	
Rb	
F	
O	
Ag	
N	
Cd	

Element	Charge
Na	
I	
P	
Li	
Al	
Ca	
Zn	
Cl	

2. Circle the elements below that would require Roman numerals as part of their chemical name in ionic compounds.

iron	sulfur	manganese	Co	Mg
Be	H	Cu	chromium	Ti
Ne	Zn	Sc	C	Si

3. The “oxy-anions” for the elements bromine and iodine are named in a manner analogous to the oxy-anions of chlorine. Use the examples on the left side of the table to complete the rest of this table. The last set is not an “oxy-anions”.

Formula	**Name**	**Formula**	**Name**	**Formula**	**Name**
Cl	**Cl**	**Br**	**Br**	**I**	**I**
ClO_4^-	perchlorate				
ClO_3^-	chlorate				
ClO_2^-	chlorite				
ClO^-	hypochlorite				
Cl^-	chloride				

4. Supply the correct name or formula for each of the following ions.

Name	Formula
chloride	
	NO_3^-
phosphate	
	SO_4^{2-}
permanganate	
chromate	
nitrite	

Name	Formula
acetate	
	OH^-
bromide	
	S^{2-}
hydrogen carbonate	
phthalate	
	$C_2O_4^{2-}$

PERIODIC TABLE, NAMES, AND SYMBOLS OF THE ELEMENTS

OBJECTIVES: To learn the names and symbols of the most common elements and to become familiar with the Periodic Table.

DISCUSSION: Chemistry is defined as the study of the structure, composition and properties of matter and of the changes that matter undergoes. Mastery of chemistry is similar to becoming fluent in a foreign language. It is a stepwise process. When you study a foreign language, you must first learn the alphabet if it is different from that of our native tongue. Similarly, before you can learn chemistry, you must become familiar with the names and symbols of the "basic building blocks of matter", the elements.

Elements are pure substances that can't be broken down to simpler pure substances by a chemical process or reaction. There are more than 105 elements that are known and have been characterized. Each is represented by a name and symbol consisting of one or two letters. The first letter is always upper case and the second is always lower case. As an example, there is a major difference between CO (a compound called carbon monoxide) and Co (the element cobalt). The symbols of the elements can be represented in tabular form called the Periodic Table (Figure 1). This consists of vertical rows called families or groups and horizontal rows called periods.

ASSIGNMENT:

A. You are responsible for the correct spelling of the names and symbols of all nonshaded elements in Figure 1.

NOTE: You are not responsible for knowing their position in the Periodic Table. A Periodic Table will always be available.

B. You are responsible for being able to identify any element if family and period number are given

C. You are responsible for being able to define the terms: **chemistry, element, group, family and period.**

PERIODIC TABLE OF THE ELEMENTS

1A																	8A
1 H 1.008	2A											3A	4A	5A	6A	7A	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3B	4B	5B	6B	7B		8B		1B	2B	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 181.0	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Figure 1. Periodic table of the elements.

OXIDATION NUMBERS OF SELECTED ELEMENTS

1A	2A	3B	4B	5B	6B	7B		8B		1B	2B	3A	4A	5A	6A	7A	8A
H +1 or -1																	He
Li +1	Be +2											B	C	N -3	O -2	F -1	Ne 0
Na +1	Mg +2											Al +3	Si	P -3	S -2	Cl -1	Ar 0
K +1	Ca +2	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn +2	Ga	Ge	As -3	Se -2	Br -1	Kr 0
Rb +1	Sr +2	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag +1	Cd +2	In	Sn	Sb	Te -2	I -1	Xe 0
Cs +1	Ba +2	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn 0
Fr +1	Ra +2	Ac	Unq	Unp	Unh	Uns	Uno	Une									

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Figure 2. Common oxidation numbers for selected elements. The oxidation numbers indicated for the non-metals represent those most commonly observed in binary ionic compounds. Those elements whose oxidation numbers you are not required to know at this time may exhibit more than one oxidation state. The -1 charge on hydrogen only occurs when hydrogen appears in a binary compound with a metal.

OXIDATION NUMBERS OF THE ELEMENTS

OBJECTIVES: To learn the charges (oxidation numbers) of elements with invariant oxidation numbers.

TERMS TO KNOW:

Ion: an atom that has gained or lost electrons to acquire a negative or positive charge

Cation: an atom that has lost electrons and thus has a positive charge

Anion: an atom that has gained electrons and thus has a negative charge

Ionic compound: a neutral compound resulting from combining cations and anions

Oxidation number (or oxidation state): the charge on an element once it has gained or lost electron(s)

DISCUSSION: After the names and symbols of the elements are mastered, we can now move to the second task: assembling these symbols and names and learning how to write formulas and name compounds.

Compounds are defined as pure substances that can be broken down to simpler pure substances by a chemical reaction. The smallest particle of an element that can take part in a chemical reaction and form a compound is called an atom. It consists of a center (nucleus) with protons and neutrons and around that nucleus are the electrons. Protons have an electrical charge of +1, neutrons have no charge, and electrons have a -1 charge. Atoms of any element in their free or uncombined state have the same number of protons in their nucleus as they have electrons around the nucleus. This results in a zero charge on any atom of any element in its free or uncombined state. Since electrons are on the exterior of an atom, they are the part(s) of atoms that are involved in chemical reactions.

When ionic compounds form, metals lose electrons and become positively charged (cations) and non-metals gain electrons and become negatively charged (anions). When metals of Family IA and silver are found in compounds, each atom loses one electron and attains a +1 charge. Members of Family IIA and cadmium and zinc attain a +2 charge, and aluminum has a +3 charge in compounds. The rest of the metals can lose variable numbers of electrons when they form compounds. For example, copper can lose one electron to become Cu^{1+}, or it can lose two electrons to become Cu^{2+}. Therefore, some metals have variable charges when found in compounds. Figure 2 shows the elements with non-variable oxidation numbers. Elements in Figure 2 with no oxidation number listed will have variable oxidation numbers.

ASSIGNMENT:

A. Know that the charge of any element in its free or uncombined state is zero.

B. Study Figure 2 and learn the elements with fixed charges (oxidation numbers). You are responsible for knowing element symbol, name, and oxidation number.

C. You are responsible for being able to define the terms: ion, cation, anion, oxidation number, ionic compound.

Table 1. POLYATOMIC IONS

Study and learn the name and formula of each of these polyatomic ions. The different sections of the table represent sets of ions of the same charge.

–1 Anions	
Formula	Name
CN^-	cyanide
SCN^-	thiocyanate
OH^-	hydroxide
NO_3^-	nitrate
NO_2^-	nitrite
CH_3COO^- (or $C_2H_3O_2^-$)	acetate
MnO_4^-	permanganate
ClO_4^-	perchlorate*
ClO_3^-	chlorate*
ClO_2^-	chlorite*
ClO^- (or OCl^-)	hypochlorite*
HCO_3^-	hydrogen carbonate (or bicarbonate**)
HSO_4^-	hydrogen sulfate (or bisulfate**)

*The "oxy-anions" for the elements bromine and iodine are named in a manner analogous to that shown here for chlorine.

**The International Union of Pure and Applied Chemistry has recommended that use of the names *bicarbonate* and *bisulfate* be discontinued.

–2 Anions	
Formula	Name
CO_3^{2-}	carbonate
$C_2O_4^{2-}$	oxalate
SO_4^{2-}	sulfate
$S_2O_3^{2-}$	thiosulfate
SO_3^{2-}	sulfite
$C_8H_4O_4^{2-}$	phthalate
CrO_4^{2-}	chromate
$Cr_2O_7^{2-}$	dichromate
O_2^{2-}	peroxide***
–3 Anions	
PO_4^{3-}	phosphate
PO_3^{3-}	phosphite
AsO_4^{3-}	arsenate
+1 Cations	
NH_4^+	ammonium
H_3O^+	hydronium
+2 Cation	
Hg_2^{2+}	mercury(I)****

***In the peroxide anion, each oxygen has a charge of –1, instead of the expected –2. Only Group I elements form peroxide compounds [e.g. hydrogen peroxide (H_2O_2) and sodium peroxide (Na_2O_2)]. Compounds such as PbO_2 (called lead(IV) oxide) is not a peroxide compound. Organic peroxides are also known, but will not concern us in CHM130.

****In the diatomic mercury(I) ion, each mercury has lost one electron (for a charge of +1), giving a total +2 charge to the complete ion.

NOMENCLATURE

OBJECTIVES: To develop the skills needed to write correct formulas from names and correct names from formulas.

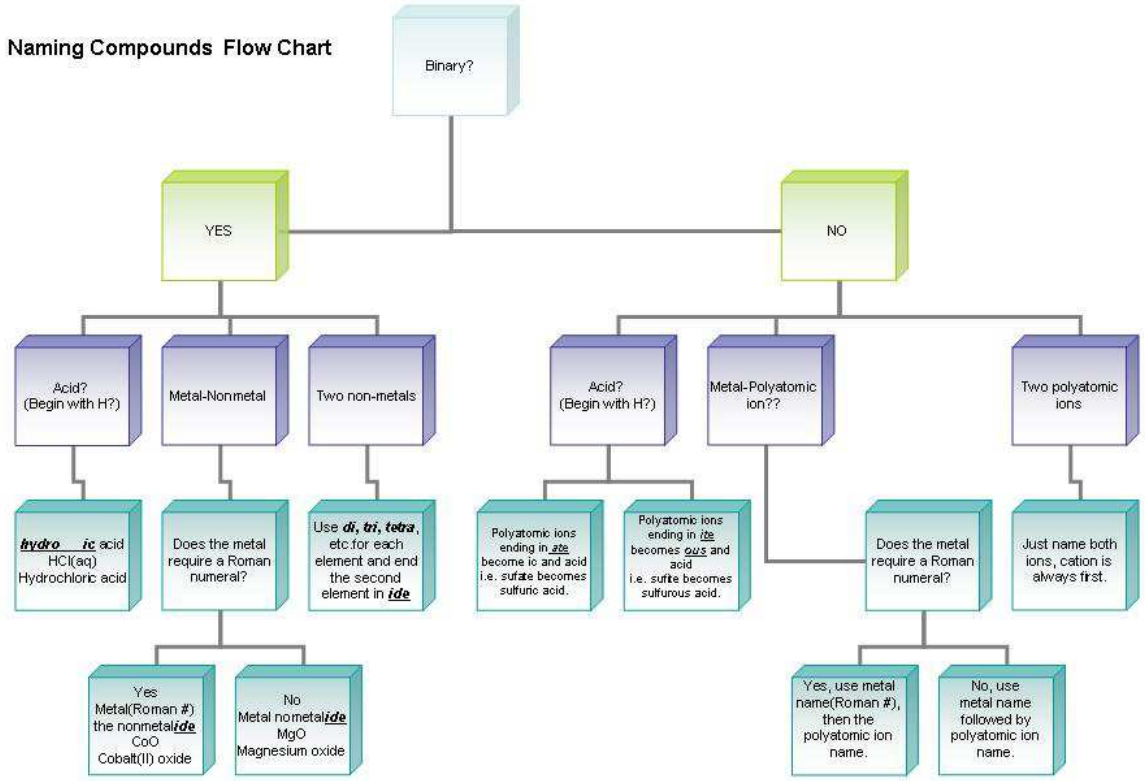
DISCUSSION: In the course of your study of chemistry you will encounter numerous compounds that you will have to recognize by formula and/or name. Either you are going to have to spend a great deal of time memorizing names and formulas, or learn some consistent rules to apply for naming compounds and writing formulas. This lab discussion and the exercises that follow will help you develop the necessary skills in naming and formula writing that you will need for this course and subsequent chemistry classes.

The nomenclature rules are to chemistry what grammar and spelling rules are to language. These rules make it possible to recognize thousands of compounds without memorizing all the formulas and names. The International Union of Pure and Applied Chemistry (IUPAC) is the international group that governs nomenclature for all branches of chemistry in all countries, so that a chemist in the United States can communicate unambiguously (at least in regard to nomenclature) with a chemist in any other country. The naming systems discussed in this brief introduction follow IUPAC rules. You must also recognize that some compounds, because they are very common and their names predated IUPAC rules by many years, are not going to follow the IUPAC rules. These compounds have names that are called "common" names. Some examples are water (H_2O), ammonia (NH_3) and methane (CH_4).

Let us begin by classifying the types of compounds that you will come across in introductory chemistry. The general types are:

1. IONIC BINARY COMPOUNDS: *metal or hydrogen with a nonmetal*
2. COVALENT BINARY COMPOUNDS: *two nonmetals*
3. IONIC TERNARY COMPOUNDS: *metal or hydrogen or ammonium with polyatomic anion*
4. BINARY ACIDS: *a binary compound of hydrogen and a non-metal, dissolved in water*, e.g., HCl (aq). The (aq) means “aqueous”, dissolved in water.
5. TERNARY ACIDS: *a ternary compound of hydrogen and a polyatomic ion, dissolved in water;* e.g., H_2SO_4 (aq).

The first step in classifying compounds is to decide whether they are binary or ternary. They are binary if they have ONLY TWO elements, ternary if they have MORE THAN TWO. Once you have assigned them to the proper group, then you need to further classify them. The following figure illustrates the scheme.



To write correct formulas or correct names you must know the names and corresponding symbols for the elements, be familiar with the oxidation numbers of the elements which have only one oxidation number (see Figure 2), know which elements have more than one oxidation number and know the names, formulas and ionic charges of the polyatomic ions listed in Table 1. These have been assigned previously to be memorized.

NOMENCLATURE OF SIMPLE INORGANIC COMPOUNDS

I. Binary Compounds

- Consist of two elements
- All binary compounds end in "–ide"

A. Metal-Nonmetal Compounds

1. Metal has only one oxidation number (See Figure 2).

These compounds are named by giving the name of the metal, followed by the root of the name of the nonmetal ending in "-ide".

KBr	potassium bromide (K has a 1+ charge and Br has a -1 charge)
$CaCl_2$	calcium chloride (Ca has a 2+ charge and each Cl has a -1 charge)

HF	hydrogen fluoride
Mg_3N_2	magnesium nitride

Note regarding hydrogen: For convenience in naming, binary compounds involving hydrogen are usually named as if hydrogen were a metal, and the compound a binary ionic one. This does not, however, make hydrogen a metal.

2. Metal has more than one possible oxidation number.

   These compounds are named by giving the name of the metal followed by its oxidation number, expressed in Roman numerals and in parentheses. The root of the name of the nonmetal, ending in "-ide", is then added.

   Examples:

FeS	iron(II) sulfide (Fe^{2+} combined with S^{2-})
Mn_2O_3	manganese(III) oxide (Mn^{3+} combined with O^{2-})

   Note that the Roman numeral applies to the charge on the metal ion, not to the number of ions.

B. Nonmetal-Nonmetal Compounds (covalent bonding)

Generally, the nonmetal element more towards the middle of the periodic table (the more electropositive element) is named first, followed by the root name of the second nonmetal element given an "-ide" ending. Prefixes are used for each element to indicate the number of atoms of each element (di, tri, tetra, penta, hexa, hepta, octa, nona, deca represent two through ten, respectively).

Examples:

CO_2	carbon dioxide
NO	nitrogen oxide
Cl_2O_7	dichlorine heptaoxide

Note regarding carbon monoxide (CO): For historical reasons, carbon monoxide is the only chemical name which still uses the prefix "mono", which means "one".

II. Ternary Compounds

- Ionic compounds consisting of more than two elements
- Rules for naming ternary compounds are essentially the same as those in IA above. The names of the polyatomic ions are used as they appear in Table 1.

Ternary compounds contain positively and negatively charges components to give a neutral compound.

Positive	+	**Negative**
metal ion		polyatomic anion
or		*or*
ammonium ion		nonmetal anion

Examples using metals with invariable oxidation numbers (I.A.1):

KCN	potassium cyanide
Na_2SO_4	sodium sulfate
$Mg_3(PO_4)_2$	magnesium phosphate

Examples using metals with more than one possible oxidation number (I.A.2):

Cu_2O	copper(I) oxide
CuO	copper(II) oxide
$Fe_2(SO_3)_3$	iron(III) sulfite
$Fe_3(SO_3)_2$	iron(II) sulfite

Examples using the ammonium ion, NH_4^+:

NH_4Br	ammonium bromide
$(NH_4)_2SO_4$	ammonium sulfate

III. Acids

- Formula usually begins with "H"

A. Binary acids (H and another nonmetal, dissolved in water)

Write the prefix *hydro*-, then the name of the second element with an *–ic* ending, followed by the word *acid*.

Examples: HBr(aq) is **hydro**brom**ic acid**
Hydrofluor**ic acid** is HF(aq)
H_2S(aq) is **hydro**sulfur**ic acid**

Note: HCN(aq) is hydrocyanic acid based on the name of the polyatomic ion *cyanide.*

B. Polyatomic acids (H and a polyatomic ion, dissolved in water)

1. If the polyatomic ion ends in *–ate:*
Write the name of the polyatomic ion, changing the *–ate* ending to *–ic*, then add the word "acid".

Examples: H_2SO_4(aq) is sulfuric acid (based on the sulfate ion, SO_4^{2-})
H_3PO_4(aq) is phosphoric acid (based on the phosphate ion, PO_4^{3-})
$HClO_4$(aq) is perchloric acid (based on the chlorate ion, ClO_4^-)

2. If the polyatomic ion ends in *–ite:*
   Write the name of the polyatomic ion, changing the *–ite* ending to *–ous*, then add the word "acid".

Examples: $HNO_2(aq)$ is nitrous acid (based on the nitrite ion, NO_2^-)
$HClO(aq)$ is hypochlorous acid (based on hypochlorite ion, ClO^-)
$HBrO_2(aq)$ is bromous acid (based on the bromite ion, BrO^-)

EXERCISES

1. Use Rule I.A to name or give formulas for the following binary ionic (metal/nonmetal) compounds.

a. Mg_3N_2 _____

b. Rb_2O _____

c. Al_2O_3 _____

d. Cu_2O _____

e. $MnCl_3$ _____

f. Zinc bromide _____

g. Silver fluoride _____

h. Iron(II) oxide _____

i. Calcium phosphide _____

j. Cobalt(III) sulfide _____

2. Use Rule I.B to name or give formulas for the following binary covalent compounds.

a. SF_6 _____

b. P_4O_{10} _____

c. NCl_3 _____

d. SO_3 _____

e. XeF_6 _____

f. Carbon disulfide _____

g. Dinitrogen pentaoxide _____

h. Silicon tetrachloride _____

i. Sulfur dioxide _____

j. Phosphorus pentafluoride _____

3. Use Rule II to name or give formulas for the following ternary ionic compounds.

a. $(NH_4)_3PO_4$ _____

b. $CoSO_4$ _____

c. $AgNO_3$ _____

d. Na_2CO_3 _____

e. $CoSO_3$ _____

f. Chromium(III) arsenate _____

g. Barium hydroxide _____

h. Potassium chromate _____

i. Ammonium nitrite _____

j. Iron(III) acetate _____

4. Use Rule III.A to name or give formulas for the following binary acids.

a. HBr (aq) _____

b. H_2S (aq) _____

c. HCl (aq) _____

d. Hydroselenic acid _____

e. Hydrofluoric acid _____

5. Use Rule III.B to name or give formulas for the following ternary acids.

a. H_2CO_3 (aq) _____

b. H_3PO_4 (aq) _____

c. $H_2C_2O_4$ (aq) _____

d. HIO (aq) _____

e. Phosphorous acid _____

f. Acetic acid _____

g. Iodous acid _____

h. Nitrous acid _____

6. Use the appropriate rule to name or give formulas for the following compounds.

a. $NaClO_2$ _____

b. NaH _____

c. Rb_2S _____

d. Cd O _____

e. NH_4NO_3 _____

f. HNO_3 (aq) _____

g. AsI_3 _____

h. $Au(CN)_3$ _____

i. PbO _____

j. H_2Se (aq) _____

k. Hydroiodic acid _____

l. Silicon dioxide _____

m. Calcium hypochlorite _____

n. Chromium(III) oxalate _____

o. Lithium oxide _____

p. Phosphorous acid _____

q. Potassium bicarbonate _____

r. Perchloric acid _____

s. Mercury(II) sulfide _____

t. Magnesium thiocyanate _____

ADDITIONAL NOMENCLATURE EXERCISES

1. calcium hydroxide
2. silver phosphate
3. hydrogen chloride
4. hydrochloric acid
5. ammonium sulfate
6. zinc sulfide
7. cadmium dichromate
8. barium chlorate
9. copper(II) sulfite
10. iron(III) nitrate
11. copper(I) iodide
12. mercury(II) chloride
13. iron(III) permanganate
14. manganese(II) hydroxide
15. nickel(II) chlorite
16. chromium(II) fluoride
17. manganese(III) hydroxide
18. sodium phosphate
19. chromium(III) arsenate
20. tin(IV) bromide
21. lead(II) oxalate
22. bismuth(V) oxide
23. aluminum perchlorate
24. mercury(II) acetate
25. cesium hydrogen carbonate
26. hydroiodic acid
27. rubidium arsenate
28. beryllium nitride
29. hydrosulfuric acid
30. antimony(III) nitrate
31. lead(II) bromide
32. sulfuric acid
33. cobalt(III) chloride
34. hydrogen selenide
35. nitrous acid
36. periodic acid
37. beryllium carbonate
38. ammonium cyanide
39. aluminum sulfide
40. chloric acid
41. nickel(II) arsenate
42. diiodine heptaoxide
43. barium nitrate
44. calcium hydride
45. dinitrogen pentasulfide
46. titanium(IV) oxide
47. iodine trichloride
48. calcium phosphide
49. lead(IV) acetate
50. sulfur hexafluoride

1. $Ca(OH)_2$
2. Ag_3PO_4
3. HCl
4. $HCl(aq)$
5. $(NH_4)_2SO_4$
6. ZnS
7. $CdCr_2O_7$
8. $Ba(ClO_3)_2$
9. $CuSO_3$
10. $Fe(NO_3)_3$
11. CuI
12. $HgCl_2$
13. $Fe(MnO_4)_3$
14. $Mn(OH)_2$
15. $Ni(ClO_2)_2$
16. CrF_2
17. $Mn(OH)_3$
18. Na_3PO_4
19. $CrAsO_4$
20. $SnBr_4$
21. PbC_2O_4
22. Bi_2O_5
23. $Al(ClO_4)_3$
24. $Hg(C_2H_3O_2)_2$
25. $CsHCO_3$
26. $HI(aq)$
27. Rb_3AsO_4
28. Be_3N_2
29. $H_2S(aq)$
30. $Sb(NO_3)_3$
31. $PbBr_2$
32. $H_2SO_4(aq)$
33. $CoCl_3$
34. H_2Se
35. $HNO_2(aq)$
36. $HIO_4(aq)$
37. $BeCO_3$
38. NH_4CN
39. Al_2S_3
40. $HClO_3(aq)$
41. $Ni_3(AsO_4)_2$
42. I_2O_7
43. $Ba(NO_3)_2$
44. CaH_2
45. N_2S_5
46. TiO_2
47. ICl_3
48. Ca_3P_2
49. $Pb(C_2H_3O_2)_4$
50. SF_6

51. aluminum chlorate
52. mercury(II) phosphate
53. bismuth(III) oxide
54. hydrogen sulfate
55. lithium arsenide
56. tin(IV) chloride
57. dichlorine heptaoxide
58. hydroiodic acid
59. bromic acid
60. copper(II) arsenate
61. gold(III) fluoride
62. aluminum acetate
63. sodium chlorate
64. tin(II) sulfide
65. mercury(II) dichromate
66. zinc phosphide
67. sulfurous acid
68. iron(III) oxide
69. boron trifluoride
70. manganese(IV) oxide
71. lead(II) carbonate
72. ammonium acetate
73. iron(III) hydrogencarbonate
74. chromium(II) sulfate
75. tin(IV) phosphate
76. iodic acid
77. potassium perchlorate
78. beryllium hydroxide
79. chromium(III) sulfide
80. dinitrogen tetroxide
81. mercury(II) carbonate
82. copper(II) nitrate
83. iodine bromide
84. silicon dioxide
85. ammonia
86. nitrogen trioxide
87. lithium phosphate
88. iodine pentaoxide
89. strontium chloride
90. vanadium(V) sulfide
91. titanium(IV) phosphide
92. magnesium hydroxide
93. gallium(III) acetate
94. selenium dioxide
95. radium bromide
96. sodium oxide
97. iron(II) chromate
98. zinc phosphate
99. nickel(III) sulfate
100. calcium carbonate

51. $Al(ClO_3)_3$

52. $Hg_3(PO_4)_2$

53. Bi_2O_3

54. H_2SO_4

55. Li_3As

56. $SnCl_4$

57. Cl_2O_7

58. $HI(aq)$

59. $HBrO_3(aq)$

60. $Cu_3(AsO_4)_2$

61. AuF_3

62. $Al(C_2H_3O_2)_3$

63. $NaClO_3$

64. SnS

65. $HgCr_2O_7$

66. Zn_3P_2

67. $H_2SO_3(aq)$

68. Fe_2O_3

69. BF_3

70. MnO_2

71. $PbCO_3$

72. $NH_4C_2H_3O_2$

73. $Fe(HCO_3)_3$

74. $CrSO_4$

75. $Sn_3(PO_4)_4$

76. $HIO_3(aq)$

77. $KClO_4$

78. $Be(OH)_2$

79. Cr_2S_3

80. N_2O_4

81. $HgCO_3$

82. $Cu(NO_3)_2$

83. IBr

84. SiO_2

85. NH_3

86. NO_3

87. Li_3PO_4

88. IO_5

89. $SrCl_2$

90. V_2S_5

91. Ti_3P_4

92. $Mg(OH)_2$

93. $Ga(C_2H_3O_2)_3$

94. SeO_2

95. $RaBr_2$

96. Na_2O

97. $FeCrO_4$

98. $Zn_3(PO_4)_2$

99. $Ni_2(SO_4)_3$

100. $CaCO_3$

101. SO_2
102. $H_2SO_3(aq)$
103. $CuSO_4 \cdot 5H_2O$
104. $K_2Cr_2O_7$
105. $KMnO_4$
106. CaS
107. Na_2O_2
108. NO_2
109. NH_4OH
110. $Fe(BrO_2)_2$
111. $H_3PO_4(aq)$
112. $Na_2SO_4 \cdot 10H_2O$
113. CO
114. P_2O_5
115. $Pb(C_2H_3O_2)_2$
116. $FeCl_3$
117. HgO
118. N_2O_3
119. $HNO_3(aq)$
120. $HClO(aq)$
121. BaH_2
122. $KHSO_3$
123. $HIO_4(aq)$
124. $LiCN$
125. $H_3As(aq)$
126. hydroarsenic acid
127. lithium cyanide
128. periodic acid
129. potassium hydrogencarbonate
130. barium hydride
131. hypochlorous acid
132. nitric acid
133. dinitrogen trioxide
134. mercury(II) oxide
135. iron(III) chloride
136. lead(II) acetate
137. diphosphorus pentaoxide
138. carbon oxide
139. sodium sulfate decahydrate
140. phosphoric acid
141. iron(II) bromite
142. ammonium hydroxide
143. nitrogen dioxide
144. sodium peroxide
145. calcium sulfide
146. potassium permanganate
147. potassium dichromate
148. copper(II) sulfate pentahydrate
149. sulfurous acid
150. sulfur dioxide