# NAMING INORGANIC COMPOUNDS

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Chemistry exercises on Inorganic Nomenclature
Periodic Table with Oxidation Numbers. Table III
1. STOICHIOMETRIC NAMES OF BINARY COMPOUNDS

1.1. With multiplying prefix

When constructing a stoichiometric name for a binary compound, one element is designated as the electropositive constituent and the other the electronegative constituent. The electropositive constituent is by convention the element that occurs last in the sequence of Table I and its name is the unmodified element name. The name of the electronegative constituent is constructed by modifying the element name with the ending ‘ide’. The stoichiometric name of the compound is then formed by combining the name of the electropositive constituent, cited first, with that of the electronegative constituent, both suitably qualified by any necessary multiplicative prefixes (Table II).

The multiplicative prefixes precede the names they multiply, and are joined directly to them without spaces or hyphens. The final vowels of multiplicative prefixes should not be elided (although ‘monoxide’, rather than ‘monooxide’, is an allowed exception because of general usage).

The two parts of the name are separated by a space in English.

Prefix + name of 1st element in the formula  Prefix + stem of 2nd element + ide

Table I

![Periodic Table]

Table II—Prefixes for number of atoms

<table>
<thead>
<tr>
<th>Number of atoms</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>mon</td>
</tr>
<tr>
<td>2</td>
<td>di</td>
</tr>
<tr>
<td>3</td>
<td>tri</td>
</tr>
<tr>
<td>4</td>
<td>tetra or tetr*</td>
</tr>
<tr>
<td>5</td>
<td>penta or pent*</td>
</tr>
<tr>
<td>6</td>
<td>hexa or hex*</td>
</tr>
<tr>
<td>7</td>
<td>hepta or hept*</td>
</tr>
</tbody>
</table>
*The first spelling is used if the stem of the element begins with a consonant and the second spelling if the stem of the element begins with a vowel.

The stem of an element is formed by dropping the last syllable of the element's name. Prefixes are assigned by the number of atoms of each element in the formula, and the prefix corresponding to a given number of atoms can be found Table II. The prefix "mon" is dropped with the exception of carbon monoxide, and the suffix "ide" is used with all two element compounds.

Carbon dioxide is a familiar example of a systematic name.

**Example 1**--What is the formula of sulfur hexafluoride?

The elements composing the compound are S and F. Also the prefix hex says there are 6 F atoms so the formula is SF₆.

**Example 2**--Name the compound N₂O₄

The name is dinitrogen tetroxide.

1.2.- **With oxidation numbers**

When constructing a stoichiometric name for a binary compound, one element is designated as the electropositive constituent and the other the electronegative constituent. The electropositive constituent is by convention the element that occurs last in the sequence of Table I and its name is the unmodified element name. The name of the electronegative constituent is constructed by modifying the element name with the ending ‘ide’,

The electropositive constituent, cited first, is followed by a roman numeral between parentheses, just in the case that this element has more than one oxidation number in the table III.

The two parts of the name are separated by a space in English.

_**Name the electropositive element (roman numerals if they have more than one) followed by the stem name of the electronegative with an -ide ending.**_

Examples:

NaCl = sodium chloride
SO₃ = sulfur(VI) oxide
CaO = calcium oxide
CaF₂ = calcium fluoride
CuO = copper(II) oxide
If you know the name and you want to write the formula then it is more complex. This system does not use prefixes and assumes a knowledge of the law of electrical neutrality, the octet rule, and ionic theory. It will be very helpful use the table III of the oxidation numbers.

**Example 2**—What is the chemical formula of cesium sulfide?

The compound is composed of cesium and sulfur. From Table, we have Cs has +1 and S has -2.

Cs₂S.

Note the ions composing cesium sulfide are Cs⁺ and S²⁻.

If the metal exhibits more than one oxidation state, the oxidation state of the metal, in the compound of interest, is indicated by a Roman numeral placed in parentheses following the name of the metal.

The Roman numeral equals the charge on the metal ion. The following examples show how the names in these compounds are assigned and used to determine the chemical formula from the name.

**Example 1**—The color of ruby and sapphire is due to a small quantity of Cr₂O₃ in these gem stones. What is the systematic name of Cr₂O₃?

The name of the compound is Chromium(III) oxide.

**Example 2**—The compound Lead(IV) oxide is used in car batteries. What is the chemical formula of Lead(IV) oxide?

Pb has +4 (from Lead(IV))

O has -2 (from Table III)

The chemical formula is PbO₂.

**Example 3**—What is the name of HgBr?

Bromine has number -1 (the last element always with the negative oxidation number)(see table III) mercury can have oxidation numbers of +1 and +2. All the compounds are neutral so the oxidation number of mercury has to be +1

It is named mercury(I) bromide.

For similar reasons HgBr₂ is named mercury(II) bromide.

**1.3. With charge number**

When constructing a stoichiometric name for a binary compound, one element is designated as the electropositive constituent and the other the electronegative constituent.

The electropositive constituent is by convention the element that occurs last in the sequence of Table I and its name is the unmodified element name. The name of the electronegative constituent is constructed by modifying the element name with the ending ‘ide’,

The electropositive constituent, cited first, is followed by an Arabic number and a plus sign (+) between parentheses, just in the case that this element has more than one oxidation number in the
The two parts of the name are separated by a space in English.

Name the electropositive element (Arabic numbers (+) if they have more than one) followed by the stem name of the electronegative with an -ide ending.

Examples:
NaCl = sodium chloride
CaO = calcium oxide
CaF₂ = calcium fluoride
CuO = copper(2+) oxide

If you know the name and you want to write the formula then it is more complex. This system does not use prefixes and assumes a knowledge of the law of electrical neutrality, the octet rule, and ionic theory. It will be very helpful use the table III of the oxidation numbers.

Example 1--The color of ruby and sapphire is due to a small quantity of Cr₂O₃ in these gem stones. What is the systematic name of Cr₂O₃?

The name of the compound is Chromium(3+) oxide.

Example 2--The compound Lead(4+) oxide is used in car batteries. What is the chemical formula of Lead(4+) oxide?

Pb has +4 (from Lead(4+))
O has -2 (from Table III)

The chemical formula is PbO₂.

Example 3.- What is the name of HgBr?
Bromine has number -1 (the last element always with the negative oxidation number)(see table III) mercury can have oxidation numbers of +1 and +2. All the compounds are neutral so the oxidation number of mercury has to be +1

It is named mercury(1+) bromide

For similar reasons HgBr₂ is named mercury(2+) bromide

Some binary compounds have a special and traditional name and this is the name that we usually are going to use.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂O</td>
<td>water</td>
</tr>
<tr>
<td>NH₃</td>
<td>ammonia</td>
</tr>
<tr>
<td>CH₄</td>
<td>methane</td>
</tr>
</tbody>
</table>
2. Bases

Bases are compounds which consist of a metal ion combined with the hydroxide polyatomic ion (OH). To name a base, name the metal (include the oxidation number in parentheses if the metal is one which has more than one oxidation state) followed by the word hydroxide.

Or you can use multiplying prefix

Examples:

NaOH is named sodium hydroxide
Ba(OH)\(_2\) is named barium hydroxide or barium dihydroxide
Fe(OH)\(_2\) is named iron(II) hydroxide or iron dihydroxide
Fe(OH)\(_3\) is named iron(III) hydroxide or iron trihydroxide

3. Acids

An acid is a compound consisting of hydrogen combined with a non-metallic element or with a polyatomic ion that has a negative oxidation number. In the formula for an acid, hydrogen is always listed as the first element.

There are several types of acids encountered in chemistry: binary acids, oxygen containing acids, and organic acids. Their names are well established in traditional origins and there has been no acceptable systematic scheme for naming these substances.

3.1 Binary or Non-oxygen Acids

Binary acids consist of hydrogen combined with an element of the groups VI or VII. Binary acids are named by using the prefix hydro- followed by the stem name of the non-metal element (the second element in the formula) with an -ic ending. The name is followed by the word acid.

Examples:

HCl is named hydrochloric acid
HBr is named hydrobromic acid
HI is named hydroiodic acid
H\(_2\)S is named hydrosulfuric acid

3.2 Oxygen-containing Acids

We are not going to study them this year, just a few names very famous

HNO\(_3\) is named nitric acid
H\(_2\)SO\(_4\) is named sulfuric acid
HClO\(_3\) which is named chloric acid
1. Name the following
   a) SO₃
   b) CO₂
   c) O₅Cl₂
   d) O₂Br₂
   e) OI₂
   f) SO₂
   g) N₂O
   h) P₂O₅

2. Write the formula for:
   a) phosphorus pentachloride
   b) carbon monoxide
   c) dinitrogen trioxide
   d) phosphorus trichloride
   e) heptooxygen dichloride
   f) palladium dioxide
   g) sulfur trioxide
   h) diphosphorus pentoxide

3. Name the following
   a) AsF₃
   b) Al₂S₃
   c) PbO₂
   d) CoCl₂
   e) CuO

4. Write the formula for
   a) gold(III) chloride
   b) Strontium fluoride
   c) Sodium oxide
   d) Dinitrogen pentoxide
   e) Potassium sulfide

5. Write the chemical formula
   a) nickel (III) sulfide
b) carbon dioxide  
c) sodium chloride  
d) silver iodide  
e) calcium oxide  
f) mercury(I) bromide  
g) cobalt(II) chloride  
h) iron(III) chloride  

6. Name the following:  
a) Mg(OH)$_2$  
b) Sn(OH)$_2$  
c) NaOH  
d) Ni(OH)$_3$  
e) Pb(OH)$_4$  

7. Write the chemical formula  
a) copper(II) hydroxide  
b) silver hydroxide  
c) cadmium hydroxide  
d) tin(II) hydroxide  
e) mercury(I) hydroxide  

8. Write the chemical formula:  
a) ammonia  
b) water  
c) methane  
d) nitric acid  
e) sulfuric acid  

9 Write the name of the following:  
a) HNO$_3$  
b) HClO$_3$  
c) H$_2$SO$_4$  
d) NH$_3$
10. Write the chemical formula:
   a) Chlorine(VII) oxide  
   b) Tin(4+) oxide  
   c) copper(2+) oxide  
   d) disodium oxide  
   e) sulfur trioxide  
   f) barium oxide  
   g) barium dihydride  
   h) copper(I) hydride  
   i) carbon disulfide  
   j) carbon(4+) chloride  
   k) phosphorus(5+) chloride  
   l) Strontium sulfide  
   m) boron trichloride  
   n) iron(III) sulfide  
   o) barium chloride  
   p) mercury(2+) hydroxide  
   q) potassium selenide  
   r) nitric acid  
   s) hydrosulfuric acid  
   t) hydrofluoric acid  

11. Name in the 3 ways:
   a) Fe$_2$S$_3$  
   b) Na$_2$S  
   c) KBr  
   d) HgCl$_2$  
   e) HI  
   f) SO$_2$  
   g) PbO$_2$  
   h) Li$_2$O  
   i) Au(OH)$_3$  
   j) SnO  
   k) Ag$_2$Se  
   l) FeO
Practice exam

1.- Write the name of the following compounds
1. Hg(OH)$_2$
2. FeCl$_3$
3. P$_2$O$_5$
4. CsH
5. CaSe
6. SrBr$_2$
7. HCl
8. TeO$_3$
9. Li$_2$O
10. NO$_2$
11. NaOH
12. O$_7$Br$_2$
13. B$_2$S$_3$
14. Au(OH)$_3$
15. NH$_3$
16. CaF$_2$
17. CuH$_2$
18. KI
19. NaCl
20. NiI$_2$

2.- Write the chemical formula:
21. hydrochloric acid
22. Iron(III) oxide
23. aluminum hydroxide
24. chloric acid
25. sulphur trioxide
26. cobalt(III) bromide
27. phosphorus pentachloride
28. methane
29. water
30. potassium hydride
31. hydrosulfuric acid
32. lead(II) sulfide
33. calcium hydride
34. heptoxygen diiodide
35. carbon dioxide
36. strontium bromide
37. silicon tetrahydride
38. gold(III) iodide
39. nitric acid
40. copper(II) hydroxide
### Periodic Table with Oxidation Numbers. Table III

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<th>2A</th>
<th>3B</th>
<th>4B</th>
<th>5B</th>
<th>6B</th>
<th>7B</th>
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</tr>
</tbody>
</table>

- **1A**: Hydrogen (H) +1
- **2A**: Lithium (Li) +1
- **3B**: Beryllium (Be) +2
- **4B**: Boron (B) +3
- **5B**: Nitrogen (N) +5
- **6B**: Oxygen (O) +2
- **7B**: Fluorine (F) -1
- **8B**: Neon (Ne) 0
- **1B**: Sodium (Na) +1
- **2B**: Magnesium (Mg) +2
- **3A**: Aluminum (Al) +3
- **4A**: Silicon (Si) +4
- **5A**: Phosphorus (P) +5
- **6A**: Sulfur (S) +6
- **7A**: Chlorine (Cl) +7
- **8A**: Argon (Ar) 0