Chemical [Nomenclature](http://www.chem.vt.edu/RVGS/ACT/notes/Nomenclature.html) & [Bonding](http://www.beyondbooks.com/psc92/3.asp)

# Ionic

**Recognize ionic compounds because they:**

a.  Are binary compounds that contain a metal and a non-metal.

b.  Contain polyatomic ions.

**Use the** [**periodic table**](http://onsager.bd.psu.edu/~jircitano/charges.html) **to predict charges on some atoms with certainty.**

1.  The metal (retains element name) or polyatomic cation is first.  If the metal is Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, Ra, or Al the charge is never indicated.  The charge is known from the [periodic table](http://onsager.bd.psu.edu/~jircitano/charges.html).

|  |  |
| --- | --- |
| NaCl | sodium chloride |
| NH4Br | ammonium bromide |

2.  Followed by the name of the nonmetal with an *-ide* ending added or the polyatomic anion.

|  |  |
| --- | --- |
| KCl | potassium chloride |
| Ca(NO3)2 | calcium nitrate |

3.  If the metal has more than one possible charge, indicate the charge using roman numerals (and no space):

|  |  |
| --- | --- |
| FeCl2 | iron(II) chloride |
| CuSO4 | copper(II) sufate |

An incorrect, but still frequently seen, method uses the Latin root and an added *-ous* for the lower charge or *-ic* for the higher charge. (Fe(ClO3)2, ferrous chlorate; Fe(ClO2)3, ferric chlorite).  Do not use this method.

# Polyatomic Ions.

## 1.  Cations.

|  |  |
| --- | --- |
| **Formula** | **Name** |
| NH4+ | ammonium ion |
| Hg22+ | mercury(I) |

## 2.Anions.

a.Only a few polyatomic anions have an *-ide* ending.

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| --- | --- |
| **Formula** | **Name** |
| CN- | cyanide |
| OH- | hydroxide |
| H2O2 | peroxide |
| O2- | superoxide |

b.  Oxyanions.  *-ate* more oxygen, -*ite* less oxygen

|  |  |
| --- | --- |
| **Formula** | **Name** |
| NO2- | nitrite |
| NO3- | nitrate |
| SO32- | sulfite |
| SO42- | sulfate |
| PO33- | phosphite |
| PO43- | phosphate |

c.  Sometimes oxyanions have an extra hydrogen

|  |  |
| --- | --- |
| **Formula** | **Name** |
| SO42- | sulfate |
| HSO4- | hydrogen sulfate (or bisulfate) |
| SO32- | sulfite |
| HSO3- | hydrogen sulfite (or bisulfite) |
| PO43- | phosphate (tribasic) |
| HPO42- | hydrogen phosphate (dibasic) |
| H2PO4- | dihydrogen phosphate (monobasic) |

d.  Sometimes there are more than two ions, sometimes only one

|  |  |
| --- | --- |
| **Formula** | **Name** |
| ClO- | hypochlorite |
| ClO2- | chlorite |
| ClO3- | chlorate |
| ClO4- | perchlorate |
| CO32- | carbonate |
| HCO3- | hydrogen carbonate ( or bicarbonate) |
| C2H3O2- | acetate |

* e.  Metals can also form oxyanions

|  |  |
| --- | --- |
| **Formula** | **Name** |
| MnO4- | permanganate |
| CrO42- | chromate |
| Cr2O72- | dichromate |

Examples

|  |  |
| --- | --- |
| **Compound** | **Name** |
| FeS | iron(II) sulfide |
| Fe2O3 | iron(III) oxide |
| Hg2Br2 | mercury(I) bromide |
| Hg(N3)2 | mercury(II) azide |
| CuI | copper(I) iodide |
| Cu(ClO4)2 | copper(II) perchlorate |
| SnF2 | tin(II) fluoride |
| SnCl4 | tin(IV) chloride |

# Molecular

Recognize molecular compound because they are binary and contain only non-metals.

1.  Start with element to the left side (most metallic) on the periodic table followed by the second element with an added *-ide* (as if it were an anion) as a suffix.

2.  ***Always*** use Greek prefixes to indicate the number of each type of atom in the compound:

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

|  |  |
| --- | --- |
| CO | carbon monoxide |
| CO2 | carbon dioxide |
| N2O5 | dinitrogen pentoxide |

Do not use *mono* for the first element.  In some cases, drop adjacent vowels caused by a prefix.

|  |  |  |  |
| --- | --- | --- | --- |
| **Formula** | **Name** |  |  |
| N2O | dinitrogen monoxide | nitrogen (I) oxide | nitrous oxide |
| NO | nitrogen monoxide | nitrogen (II) oxide | nitric oxide |
| N2O3 | dinitrogen trioxide | nitrogen (III) oxide |  |
| NO2 | nitrogen dioxide | nitrogen (IV) oxide |  |
| N2O5 | dinitrogen pentoxide | nitrogen (V) oxide |  |
| CI4 | carbon tetraiodide |  |  |
| S2Cl2 | disulfur dichloride |  |  |

# Acids

1.  Hydro acids: h*ydro* + halogen name + *ic*

|  |  |
| --- | --- |
| **Formula** | **Name** |
| HCl | hydrochloric acid |
| HF | hydrofluoric acid |

2.  Oxoacids: polyatomic ion + acid.  Recognize as polyatomic ions with a hydrogen at the beginning of the formula.  Name with *-ous* (replacing -*ite* and *-ic* replacing *-ate* suffix)

|  |  |  |
| --- | --- | --- |
| **Formula** | **Name** | **Source** |
| HNO3 | nitric acid | nitric from nitrate |
| HNO2 | nitrous acid | nitrous from nitrite |
| H2SO4 | sulfuric acid | sulfuric from sulfate |
| H2SO3 | sulfurous acid | sulfurous from sulfite |