

Chemical Formulas for Ionic Compounds (Using Polyatomic Ions)

Beyond Binary Ionic Compounds – Using Polyatomic Ions

As you know, binary ionic compounds contain only two different elements. But many compounds contain more than two different elements. Two or more different elements hook together to make an ion (usually an anion)- since it is made of many atoms, it is called a polyatomic ion.

For example SO_4^{2-} which is called sulfate or SO_3^{2-} called sulfite

You have a list of polyatomic ions on the back of your laminated Periodic Table. In this course you will not be required to memorize them. You can always refer to the chart.

What's going on with the names?

Notice the names - single element anions carry the name of the element with an -ide on the end.

Most of the polyatomic ions end in **-ite**, or **-ate**.

•nitrite, nitrate NO_2^- NO_3^-

•chlorite, chlorate (hypochlorite, perchlorate) ClO_2^- ClO_3^- (ClO^- ClO_4^-)

There are a few exceptions that end in -ide

- hydroxide OH^-
- cyanide CN^-
- ferricyanide $\text{Fe}(\text{CN})_6^-$
- ferrocyanide $\text{Fe}(\text{CN})_6^{4-}$

Problems to avoid

Be alert for the need with parentheses when the compound contains more than one polyatomic

- magnesium nitrate should be $\text{Mg}(\text{NO}_3)_2$ not MgNO_3_2
- aluminum cyanide must be $\text{Al}(\text{CN})_3$ not AlCN_3 leaving the () off would mean 3 N's and 1 C, but you need 3 CN's

When you are working backwards and trying to figure a Roman numeral polyatomic ions sometimes can be tricky.

- Suppose you are given the formula $\text{Co}_2(\text{SO}_4)_3$ and asked for the name.
 - You could use either the “uncriss-cross and check” or the “start with the negative ion to determine the total charge” method, and hopefully you will end up with cobalt(III) sulfate.
- What if you were to determine the name of CuNO_3 ?
 - Be careful with the “3”. You may be tempted to think of having 3 nitrates, but there is only one there, so the negative charge is 1- not 3- .
 - Thus the copper has a 1+ charge and the
 - In other words, don't uncross-cross the 3.

Ammonium – Be alert for the positive polyatomic ion

Look on your Polyatomic ion chart and see that there is one important exception on the polyatomic ion chart: the positive polyatomic ammonium NH_4^+ we will treat it just like the metallic ions.

- ammonium hydroxide NH_4OH
- ammonium sulfate $(\text{NH}_4)_2\text{SO}_4$
- ammonium chloride NH_4Cl