Writing Formulas Flow Chart

Does the name of the formula include the word "ion"?

no – go to the next page

yes – simply write the formula of the ion. Use the periodic table to help you with the charges (oxidation numbers) of monoatomic ions.

Cation Help

NH_4^{1+} is ammonium ion. Transition metals and the metals to the right of the transition metals on the periodic table have a roman numeral in the name to indicate the oxidation state of the metal **except for zinc, cadmium and silver.** Other cations get the charge based on the number of valence electrons they will lose to achieve a noble gas configuration.

example: iron (III) ion is Fe^{+3} aluminum ion is Al^{+3} silver ion is Ag^{+1} sodium ion is Na^{+1}

Notice that all elements with "ion" in the name **must** have a charge in the formula.

Anion Help

1. You **must** memorize the 13 "standard" anions, both the number of atoms and the charge. Most of these end in "ate", the two exceptions are hydroxide ion (OH^{1-}) and cyanide ion (CN^{1-}).

2. If there is one more oxygen than the "standard" ion the prefix of "per" is added to the name. Example chlorate ion is ClO_3^{1-} so if the ion you are considering is ClO_4^{1-} the name is perchlorate ion.

3. If there is one less oxygen than the "standard" ion the "ate" ending is changed to an "ite" ending. Example: chlorate ion is ClO_3^{1-} so if the ion you are considering is ClO_2^{1} the name is chlorite ion.

4. If there are two less oxygen than the "standard" ion, a "hypo" prefix is added and the "ate" ending is also changed to an "ite" ending. Example: chlorate ion is ClO_3^{1-} so if the ion you are considering is ClO^{1} the name is hypochlorite ion.

5. If there is a hydrogen attached to the "standard" ion (also changing the charge by +1) a prefix of "bi" **or** "hydrogen" is used to indicate this. Example: sulfate ion is SO_4^{2-} so HSO_4^{1-} is bisulfate ion or hydrogen sulfate ion.

6. If the anion is a single element change the name to end in "ide". Example NH_4Cl the name of the anion is chloride ion (Cl^{1-}). The name of the compound is ammonium chloride.

Is the formula an element?

yes

Is it a diatomic element (hydrogen – H_2, nitrogen – N_2, oxygen – O_2, fluorine – F_2, chlorine – Cl_2, bromine – Br_2, iodine – I_2, astatine – At_2)

If it is not a diatomic element the formula is just the symbol. Example: sodium is Na, silver is Ag, tin is Sn. Notice that **elements** do not have a charge.

no

Does the name have prefixes of mono, di, tri, tetra , etc.? If it does (except for dihydrogen phosphate, dihydrogen phosphite or dichromate) simply use the prefixes to write the formula. For help with prefixes look at your Naming Compounds Flow Chart.

Example: dinitrogen trioxide is N_2O_3
carbon dioxide is CO_2
sulfur hexafluoride is SF_6

ELSE

1. Write the formula for the cation and then the formula for the anion (see other side for help).

2. Use subscripts to make the charges add to zero (the positive charge of the cation must cancel the negative charge of the anion. Do not write subscripts of one (the number one is "implied" just like in algebra – x is really 1x, the one is implied). Because the total charge is zero there should be no charges left in the formula.

3. If the ion needs subscripts **and** is a polyatomic ion then put parentheses around the ion before the subscript.

Examples: lithium sulfate is Li_2SO_4 because lithium ion is Li^{1+} and sulfate is SO_4^{2-} because two lithium ions at a 1- charge are needed to "balance" the sulfate ion at a 2- charge.

ammonium carbonate is $(NH_4)CO_3$ because ammonium ion is NH_4^{1+} and carbonate ion is CO_3^{2-}. because two ammonium ions are needed to "balance" the carbonate ion and ammonium ion is a poly atomic ion parentheses are used around the ammonium ion.

iron (III) bisulfite is $Fe(HSO_3)_3$ Iron (III) ion is Fe^{3+}. Sulfate ion is SO_4^{2-} so bisulfate ion is HSO_3^{1-}. Combining them to get a zero charge requires 3 bisulfate ions for the one iron (III) ion.