

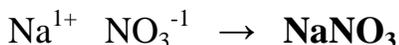
I. Writing Formulas for Ionic Compounds

The ions charges must (be multiplied to) make neutral compounds.

We must have the same number of positive charges as negative charges, so that the total charge equals zero.

Ex. 1) sodium nitrate

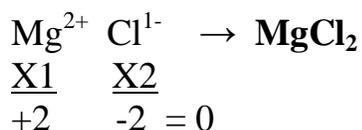
Look up sodium on the periodic table. It is in the +1 column. Nitrate you will have memorized, since it has more than one element (more than one capital letter). Look on the ion sheet. It is -1. A perfect match so just write down the compound.



Ex. 2) magnesium chloride

Look up magnesium on the periodic table. It is in the +2 column. Chloride is chlorine. Notice, all of the **negative single element ions** in column #15, 16 and 17 now have **“-ide”** endings on their names. Chloride is in the -1 column.

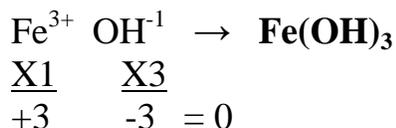
To make the +2 cancel with the -1, we must multiply the -1 by 2. Now the charges add up to zero. Since we multiplied the Cl by 2, there now appears a subscript 2 in the compound formula. ****Whenever we multiply that multiple becomes the subscript for that ion.**



Ex. 3) iron III hydroxide

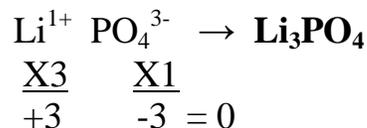
Look up iron on the periodic table. It is Fe and it is in the middle of the table. These elements can have different charges. The roman numeral will tell us the amount of positive charge. The roman numeral III in the name tells us it is +3 charged.

Hydroxide you will have memorized, since it has two capitals and is thus more than one element. (See ion sheet.) Hydroxide is -1. To make the +3 and -1 cancel, we must multiply the -1 by 3. This 3 will be the subscript in the formula. We also need parenthesis around the OH, since it is more than one element. We want 3 times the O **and** 3 times the H (not just 3 times the H). ****We did not need parenthesis in example 2, since the chloride is a single element!**



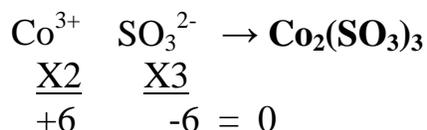
Ex. 4) lithium phosphate

Lithium is in the +1 column and phosphate is more than one element (2 capitals), so look for it on the ion sheet. Phosphate is -3. **(Whether the charge is written -3 or 3- makes no difference. Likewise +3 or 3+ are the same.)** To make the +1 and -3 cancel, we will need to multiply the +1 by 3. This will become the subscript for Li. We do not need parenthesis, since Li is a single element.



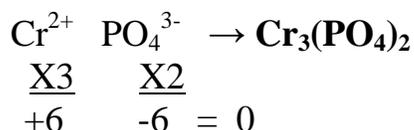
Ex. 5) cobalt III sulfite

Cobalt is in the middle of the periodic table, so the roman numeral will tell us its' charge (+3). Sulfite is on your ion sheet and is -2. To make the +3 and -2 cancel, we must multiply to get a common multiple, like when we get common denominators when adding fractions. Multiply to make a total charge of 6. The multiplied numbers become the subscripts in the formula. We need parenthesis for the sulfite, since it has more than one element in it.



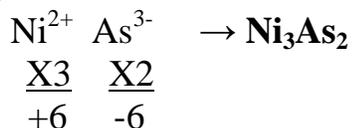
Ex. 6) chromium II phosphate

Chromium is in the middle, but the roman numeral tells us it is +2. Phosphate you have memorized and it is -3 on your ion sheet. To make the +2 and -3 cancel, we must multiply to get a common multiple, like when we get common denominators when adding fractions. Multiply to make a total charge of 6. The multiplied numbers become the subscripts in the formula. We need parenthesis for the phosphate, since it has more than one element in it.



Ex. 7) nickel II arsenide

Nickel is in the middle, but the roman numeral tells us it is +2. The arsenide is in the negative 3 column on the periodic table, so it is -3. To make the +2 and -3 cancel, we must multiply to get a common multiple, like when we get common denominators when adding fractions. Multiply to make a total charge of 6. The multiplied numbers become the subscripts in the formula.



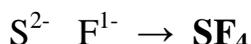
II. Writing Formulas for Covalent Molecules

These compounds contain 2 nonmetals (both (-)), so they will share electrons in different combinations.

Prefixes: mono (1), di (2), tri (3), tetra (4), penta (5), hexa (6), hepta (7), octa (8), nano (9), deca (10). **mono only used on 2nd element

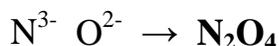
Ex. 1) sulfur tetrafluoride

The sulfur is in the -2 column on the periodic table and the fluoride is in the -1 column on the periodic table. Since both are negative, their charges will not cancel. This will not be an ionic compound, since the charges will not cancel. The electrons will be shared in a covalent compound. Since the electrons will be shared the charges do not matter. The prefixes will tell us how many of each element in the compound. Sulfur has no prefix; this is understood to be mono, since mono is never used on the first element. Mono is 1, so one Sulfur. Fluoride has tetra, which means 4. Fluoride gets a subscript 4, so it is written like a compound.



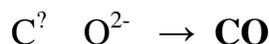
Ex. 2) dinitrogen tetroxide

Nitrogen is in the -3 column and oxide is in the -2 column on the periodic table. Since they are both negative, they will share electrons in a covalent compound. Ignore the charges, since the prefixes will tell us the amounts. Nitrogen is di, so 2. Oxygen is tetra, so 4. The amounts become the subscripts in the formula.



Ex.3) carbon monoxide

Carbon and Silicon will always share and be covalent. They will not be positive, since Carbon is a non-metal. Si is a metalloid and they usually behave charge-wise as non-metals (negative). Notice all of these covalent compounds are made between 2 non-metals. Oxygen is in the -2 column. The prefixes will tell us the amounts. Carbon has no prefix, so mono which is 1. Oxide is mono, so 1. They both get subscripts of 1. The ones do not need to be written.

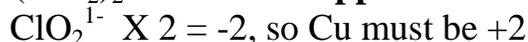


III. Naming Ionic Compounds

Ex. 1) Sr(OH)₂ **strontium hydroxide**

Strontium is in the +2 column on the periodic table, so it is +2. **Since strontium is always +2, it does not need a roman numeral!** Hydroxide is -1. In the compound there are two hydroxides, since you will need 2 X (the -1 of hydroxide) to cancel the +2 of strontium. **The name does not get prefixes, since it is ionic and not covalent!** (You do not need to name the 2 on the hydroxide, because the strontium and hydroxide charges will only cancel out in one combination!)

Ex. 2) Cu(ClO₂)₂ **copper II chlorite**



Copper is in the middle of the periodic table; it needs a roman numeral for its' charge. To find its' charge we must work backwards from the negative ion, which is known. Chlorite you have memorized (on ion sheet) as being -1. There are 2 chlorites that are each -1. That makes a -2 charge. To cancel the -2 charge, the copper must be +2, so it will be copper II.

Ex. 3) CrBr₃ **chromium III bromide**



Chromium is in the middle of the periodic table; it needs a roman numeral for its' charge. To find its' charge we must work backwards from the negative ion, which is known. Bromide is in the -1 column on the periodic table. There are 3 bromides that are each -1. That makes a -3 charge. To cancel the -3 charge, the chromium must be +3, so it will be chromium III.

Ex. 4) $\text{Fe}_2(\text{SO}_4)_3$ **iron III sulfate**
 $\text{SO}_4^{2-} \times 3 = -6$, so Fe side must be +6,
But there are 2 Fe, so each must be +3

Iron is in the middle of the periodic table; it needs a roman numeral for its' charge. To find its' charge we must work backwards from the negative ion, which is known. Sulfate you have memorized (on ion sheet) as being -2. There are 3 sulfates that are each -2. That makes a -6 charge. To cancel the -6 charge, the irons must be +6, but there are 2 irons. The 2 irons **together** equal +6, so each separate iron must be +3 ($2 \times \text{Fe}^{+3} = +6$). Thus, iron III.

Ex. 5) Cr_2O_3 **chromium III oxide**
 $\text{O}^{2-} \times 3 = -6$, so Cr side must be +6,
But there are 2 Cr, so each must be +3

Chromium is in the middle of the periodic table; it needs a roman numeral for its' charge. To find its' charge we must work backwards from the negative ion, which is known. Oxide is in the -2 column on the periodic table. There are 3 oxides that are each -2. That makes a -6 charge. To cancel the -6 charge, the chromiums must be +6, but there are 2 chromiums. The 2 chromiums **together** equal +6, so each separate chromium must be +3 ($2 \times \text{Cr}^{+3} = +6$). Thus, chromium III.

Ex. 6) $\text{Co}_3(\text{PO}_4)_2$ **cobalt II phosphate**
 $\text{PO}_4^{3-} \times 2 = -6$, so Co side must be +6,
But there are 3 Co, so each must be +2

Cobalt is in the middle of the periodic table; it needs a roman numeral for its' charge. To find its' charge we must work backwards from the negative ion, which is known. Phosphate you have memorized (on ion sheet) as being -3. There are 2 phosphates that are each -3. That makes a -6 charge. To cancel the -6 charge, the cobalts must be +6, but there are 3 cobalts. The 3 cobalts **together** equal +6, so each separate cobalt must be +2 ($3 \times \text{Co}^{+2} = +6$). Thus, cobalt II.

Ex. 7) $\text{Ba}(\text{NO}_3)_2$ **barium nitrate**

Barium is in the +2 column on the periodic table, so it is +2. **Since barium is always +2, it does not need a roman numeral!** Nitrate is -1. In the compound there are two nitrates, since you will need 2 X (the -1 of nitrate) to cancel the +2 of strontium. **The name does not get prefixes, since it is ionic and not covalent!** (You do not need to name the 2 on the nitrate, because the barium and nitrate charges will only cancel out in one combination!)

IV. Naming Covalent Molecules

Ex. 1) NO_2 N^{3-} O^{2-} prefixes: **nitrogen dioxide**
(mono never used on 1st element)
**Only the 2nd name gets the “-ide”.

Nitrogen and oxygen are both negative, so they will share electrons (covalent). Since they do not have positive and negative charges, they will not cancel; we will use prefixes for the amounts. (They can share electrons in different combinations.) Once we know that they are both negative, we can ignore the charges! Just look at the amounts for the prefixes. 1 nitrogen, so mono, but mono is never used on the 1st element, so the name is just nitrogen. 2 oxygens, so di. Only the 2nd negative ion gets the “-ide” ending, so dioxide.

Ex. 2) ICl_3 I^{1-} Cl^{1-} **iodine trichloride**

Iodine and chlorine are both negative, so they will share electrons (covalent). Since they do not have positive and negative charges, they will not cancel; we will use prefixes. (They can share electrons in different combinations.) Once we know that they are both negative, we can ignore the charges! Just look at the amounts for the prefixes. 1 iodine, so mono, but mono is never used on the 1st element, so the name is just iodine. 3 chlorines, so tri. Only the 2nd negative ion gets the “-ide” ending, so trichloride.

****Think of metalloids as negative.**

Metalloids (-) with Nonmetals (-) are covalent: SiCl_4 **silicon tetrachloride**

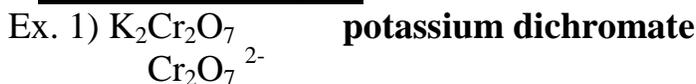
Silicon is a metalloid, so think of it as negative. If both elements are negative, they will share electrons, so the bond will be covalent. 1 silicon, so mono, but mono is never used on the 1st element, so the name is just silicon. 4 chlorines, so tetra. Only the 2nd negative gets the “-ide” ending, so tetrachloride.

Metalloids (-) with Metals (+) are ionic: Fe_3As_2 **iron II arsenide**

$$\begin{aligned} \text{As}^{-3} \times 2 &= -6, \text{ so Iron side will be } +6. \\ 3 \text{ Fe} &= +6 \quad (3 \text{ irons, so each must be } +2) \\ \text{Fe} &= +2 \end{aligned}$$

Arsenic is a metalloid, so think of it as negative. Since it is with iron, a metal, which is positive, it will be named ionically. Arsenic is in the nitrogen column, so it should be -3. Since there are 2 arsenics, together they will equal a total charge of -6. The iron side will need to be +6 to cancel that, but there are 3 irons making up the total +6 charge. Each iron will be +2.

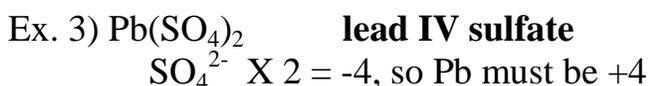
V. Mixed Examples



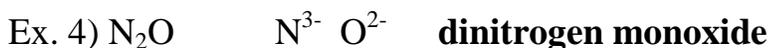
Potassium is in the +1 column on the periodic table, so it is +1. There are 2 potassiums, that together will be +2. This will cancel with the -2 charge of dichromate, which you have memorized (on ion table). **Since potassium is always +1, it does not need a roman numeral! The name does not get prefixes, since it is ionic and not covalent! (You do not need to name the 2 on the potassium, because the potassium and dichromate charges will only cancel out in one combination!)**



Phosphorus and fluorine are both negative, so they will share electrons (covalent). Since they do not have positive and negative charges, they will not cancel; we will use prefixes. (They can share electrons in different combinations.) Once we know that they are both negative, we can ignore the charges! Just look at the amounts for the prefixes. 1 phosphorus, so mono, but mono is never used on the 1st element, so the name is just phosphorus. 5 fluorines, so penta. Only the 2nd negative ion gets the “-ide” ending, so pentafluoride.



Lead is in the middle of the periodic table; it needs a roman numeral for its' charge. To find its' charge we must work backwards from the negative ion, which is known. Sulfate you have memorized (on ion sheet) as being -2. There are 2 sulfates that are each -2. That makes a -4 charge. To cancel the -4 charge, the lead must be +4, thus lead IV.



Nitrogen and oxygen are both negative, so they will share electrons (covalent). Since they do not have positive and negative charges, they will not cancel; we will use prefixes. (They can share electrons in different combinations.) Once we know that they are both negative, we can ignore the charges! Just look at the amounts for the prefixes. 2 nitrogens, so dinitrogen. 1 oxygen, so mono. Only the 2nd negative ion gets the “-ide” ending, so monoxide.



Beryllium is in the +2 column on the periodic table, so it is +2. **Since beryllium is always +2, it does not need a roman numeral!** Fluoride is -1. In the compound there are two fluorides, since you will need 2 X (the -1 of fluoride) to cancel the +2 of beryllium. **The name does not get prefixes, since it is ionic and not covalent! (You do not need to name the 2 on the fluoride, because the beryllium and fluoride charges will only cancel out in one combination!)**

End of Notes