

Naming Ionic and Molecular Compounds and Writing Formulas

A compound is made of two or more elements.

The name should tell us how many and what type of atoms there are.

We have already examined two types of compounds:

A. Ionic compounds

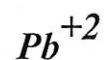
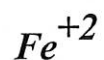
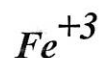
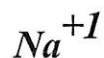
- Made of cations and anions.
- Metals and nonmetals.
- The electrons lost by the cation are gained by the anion.

I. Naming Monoatomic Ions

Cation

- Representative metal - if the charge is always the same (Group A) just write the name of the metal. (It does not change)
- Transition metals can have more than one type of charge. Indicate the charge with roman numerals in parenthesis.

Name these:



Write Formulas for these:

Potassium ion
ion

Magnesium ion

Copper (II)

Chromium (VI) ion
(II) ion

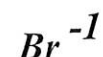
Barium ion

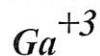
Mercury

Anion

- ü Change the element ending to – ide
- ü Ie. Fluorine (F) would become Fluoride (F^{-1})

Name these:





Write Formulas for these:

Sulfide ion

Iodide ion

Phosphide ion

II. Naming Polyatomic Ions

Polyatomic ions are groups of atoms that stay together and have a charge. You must memorize the following common polyatomic ions:

Nitrate NO_3^{-1}

Sulfate SO_4^{-2}

Phosphate PO_4^{-3}

Nitrite NO_2^{-1}

Sulfite SO_3^{-2}

Phosphite PO_3^{-3}

Carbonate CO_3^{-2}

Hydroxide OH^{-1}

Ammonium

NH_4^{+1}

III. Naming Binary Ionic Compounds

Binary Compounds consist of 2 elements. Simply name the two ions.

Representative elements:

Ex. 1. $NaCl = Na^{+} Cl^{-} =$ sodium chloride

Ex. 2 $MgBr_2 = Mg^{+2} Br^{-} =$ magnesium bromide

Transition metals:

- Need to first figure out their charges, then indicate the charge in brackets following the name of the metal.
- The compound must be neutral (same total number of + and - charges).
- Use the anion to determine the charge on the positive ion.

Examples: Naming Binary Ionic Compounds Containing Transition Metals

1. Write the name of CuO
 - Need the charge of Cu
 - The charge of O is -2
 - Therefore copper must be +2
 - Name: Copper (II) chloride
2. Name CoCl_3
 - Cl is -1 and there are three of them = -3
 - Co must be +3
 - Name: Cobalt (III) chloride
3. Name Cu_2S
 - Since S is -2, the Cu_2 must have an overall charge of +2, so each ion is +1.
 - Name: Copper (I) sulfide
4. Fe_2O_3
 - Each O is -2; therefore $3 \times -2 = -6$ charge
 - 3 Fe must = +6, so each Fe ion is +2.
 - Name: Iron (III) oxide

Write the names of the following binary ionic compounds:

1. KCl
2. Na_3N
3. CrN
4. Sc_3P_2
5. PbO
6. PbO_2
7. Na_2Se

IV. Naming Ternary Ionic Compounds

Ternary Compounds consist of 3 or more elements. Name the two ions. At least one of the ions will be polyatomic – note: the suffix of the polyatomic ion does not change.

Example: K_3PO_3 is potassium phosphite

Write the names of the following ternary ionic compounds:

8. NaNO_3
9. CaSO_4
10. CuSO_3
11. $(\text{NH}_4)_2\text{O}$

12. LiCN
13. $\text{Fe}(\text{OH})_3$
14. $(\text{NH}_4)_2\text{CO}_3$
15. NiPO_4

V. Writing Chemical Formulas

A chemical formula shows the kind and number of atoms in the smallest piece of a substance.

- The overall charge of the compound is zero.
- Balance the charges by adding subscripts.
- Put polyatomic ions in brackets when using a subscript.

Example: Write the formula for calcium chloride.

Calcium is Ca^{+2} , Chloride is Cl^{-1} ,

$\text{Ca}^{+2} \text{Cl}^{-1}$ would have a +1 charge, therefore another Cl^{-1} is needed

Chemical formula: CaCl_2

Write the chemical formula of the following compounds:

1. Lithium sulfide
2. tin (II) oxide
3. tin (IV) oxide
4. Magnesium fluoride
5. Copper (II) sulfate
6. Iron (III) phosphide
7. gallium nitrate
8. Iron (III) sulfide
9. Ammonium chloride
10. ammonium sulfide
11. barium nitrate

Things to look for

- If cations have brackets in the name, the number is their charge.
- If anions end in -ide they are probably off the periodic table (Monoatomic)
- If anion ends in -ate or -ite it is polyatomic

B. Molecular compounds

- Made of molecules.
- Made by joining nonmetal atoms together.

I. Naming Molecular Compounds

The name of a molecular compound indicates the type and number of atoms. Prefixes are used to tell you the number. You must memorize the following prefixes.

Prefixes

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

To name a molecular compound, write two words:

Prefix + Name of first nonmetal + Prefix + Name of second nonmetal + ide

Exceptions:

- don't write mono- if there is only one of the first element.
- don't use the following double vowels when writing names (oa oo)

Name these molecular compounds:

1. N_2O
2. NO_2
3. Cl_2O_7
4. CBr_4
5. CO_2
6. $BaCl_2$

Write formulas for these:

1. diphosphorus pentoxide
2. tetraiodide nonoxide
3. sulfur hexafluoride
4. nitrogen trioxide
5. Carbon tetrahydride
6. phosphorus trifluoride
7. aluminum chloride