## Naming Compounds Tutorial and Worksheet

Since we use different methods in naming covalent (molecular) compounds and ionic compounds, the **first step** in naming or writing the formula of a compound is to **determine which of the 2 compound classes it belongs**. This can be done as follows:



The only exception we will see to the above flow chart is when we see the polyatomic ion **ammonium (NH4+)** combined with any anion; in those cases the compound is **ionic** even though the compound is composed of non-metals only.

#### Once it is determined that the compound is ionic or covalent, the student can be asked to do either of the following:

1. Given the **name** of the compound, write the **formula**.

**Or**

1. Given the **formula** of the compound, write the **name**.

#### In this tutorial we will review the process for achieving these 2 objectives and practice with some worksheet problems. First, we will review and practice how to write formulas for compounds when given the compound’s name. Second, we will review and practice how to write the name of a compound when given the compound’s formula.

Writing Formulas for Compounds



**Chem 10 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 **Class: \_\_\_\_\_\_\_\_\_\_**

**A. Naming Ionic compounds**

* **Ionic compound**: bonding between **\_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Anion** is a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** charged ion (Cl-, O2-, NO3-).
* **Cation** is a **\_\_\_\_\_\_\_\_\_\_\_\_\_** charged ion (K+, Al3+, NH4+).
* **Monatomic**: species made up of **\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** (Ne, Na+, I-).
* **Diatomic**: species made up of **\_\_\_\_\_\_\_\_\_\_\_** (O2, NaCl, I2, LiBr).
* **Triatomic**: species made up of **\_\_\_\_\_\_\_\_\_\_\_\_\_** (K2S, O3, H2O).
* **Polyatomic**: species made up of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (Poly means more than one). (CH4, C2H6O, NaCl)

**B. Exercise**

1a) SO42- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ d) OH- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_

 b) H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ e) NH4+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c) Sr2+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ f) Ar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**C. Naming Monatomic ions**

1. Naming monatomic metal ions

 A. K --> K+ Potassium metal (or atom) forms the **potassium ion**.

 Be --> Be+ Beryllium forms the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* + 1. If there is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ possible charge: use Roman numerals in brackets between the metal name and the word ion.

Example: Fe3+ = iron (III) ion, Fe2+ = iron (II) ion, Cu3+ = copper (III) ion.

1. Naming monatomic non-metal ions: Change the ending of the non-metal to “ide”. (ide means that the ion has a negative charge.)

|  |  |  |  |
| --- | --- | --- | --- |
| **Element name** | **Symbol** | **Ion name** | **Ion symbol** |
| Fluor**ine** | F | Fluoride |  |
| Chlor**ine** | Cl |  | Cl- |
| Brom**ine** | Br | Bromide |  |
| Iod**ine** | I |  | I- |
| Ox**ygen** | O | Oxide |  |
| Sulph**ur** | S |  | S2- |
| Selen**ium** | Se | Selenide |  |
| Nitrogen | N |  | N3- |
| Phosph**orus** | P | Phosphide |  |
| Carb**on** | C |  | C4- |

**D. Polyatomic ions**

* Polyatomic ions are compounds that carry a charge.
* Memorize the following polyatomic ions and their charges

|  |  |
| --- | --- |
| **Name** | **Symbol and Charge** |
| Carbonate |  |
|  | NO3- |
| Phosphate |  |
|  | OH- |
| Sulfate |  |
|  | MnO4- |
| Chromate |  |
|  | CH3COO- |
| Dichromate |  |
|  | NH4+ |

**E. Self-Test: Close your textbook.** Give the symbol name the where the element name is given & give the element name where the symbol is given.

|  |  |  |  |
| --- | --- | --- | --- |
| a) sodium | b) K | c) thallium | d) Hg |
| e) silicon | f) Kr | g) fluorine | h) Cr |
| i) sulphur | j) Cs | k) cadmium | l) Be |
| m) arsenic | n) Mo | o) platinum | p) Cu |
| q) tungsten | r) Pb | s) astatine | t)B |

* Do you know these symbols and names?

**F. Writing Formulas of Ionic Compounds**

1. Positive ion first & negative ion second
2. criss-cross
3. reduce if possible
4. do not write the number 1



**Answer**: Na2 (CrO4)1 --> **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Examples:

1. Barium chloride =  **Ba2+ Cl-, 🡪 Ba1Cl2 🡪 \_\_\_\_\_\_\_\_\_\_\_**
2. Barium Oxide = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Iron (II) phosphate= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NAMING AND WRITING FORMULAS**

**FOR IONIC COMPOUNDS**

|  |  |
| --- | --- |
| **A: Name the following compounds** | **B: Write the formulae for the following compounds** |
| 1) CaCl2 |  | 1) sodium chloride |  |
| 2) AgCl |  | 2) potassium bromide |  |
| 3) MgO |  | 3) calcium iodide |  |
| 4) NaBr |  | 4) zinc oxide |  |
| 5) Al2O3 |  | 5) silver sulphide |  |
| 6) KI |  | 6) potassium sulphide |  |
| 7) ZnCl2 |  | 7) barium hydride |  |
| 8) Li2O |  | 8) silver oxide |  |
| 9) BaO |  | 9) lithium chloride |  |
| 10) CaBr2 |  | 10) hydrogen bromide |  |
| 11) MgCl2 |  | 11) magnesium chloride |  |
| 12) AgI |  | 12) lithium nitride |  |
| 13) ZnS |  | 13) zinc bromide |  |
| 14) BaF2 |  | 14) sodium iodide |  |
| 15) Ca3P2 |  | 15) barium chloride |  |
| 16) Na2O |  | 16) potassium hydride |  |
| 17) AlN |  | 17) aluminum sulphide |  |
| 18) NiBr2 |  | 18) calcium silicide |  |
| 19) Ca2C |  | 19) calcium sulphide |  |
| 20) K2O |  | 20) magnesium phosphide |  |
| 21) H2S |  | 21) barium carbide |  |
| 22) Na3N |  | 22) sodium hydride |  |
| 23) LiF |  | 23) magnesium fluoride |  |
| 24) AlCl3 |  | 24) zinc nitride |  |
| 25) NiO |  | 25) aluminum carbide |  |

**G. Naming Ionic Compounds**

**STEPS**

1. Uncross the charges and "ide" ending on second atom (Li2O = Li+ O2- = lithium oxide
* ( you are **FINISHED** **IF** cation only has one charge otherwise continue)
1. What is total charge of anion? (ex. PbO2 => O2- x 2 atoms = -4)
2. Cation must neutralize( Pb = +4)
3. Use Roman Numerals to state combining capacity ( lead(IV) oxide)

Examples:

1. MgBr2 = Mg2+ Br- = **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
2. K2O = K+ O2- = **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
3. Fe(OH)3 = Fe3+ OH-= **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** *use polyatomic ion name*
4. FeO = Fe+ O-, = Fe2+ O2- = **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
5. WBr6 = W+6 Br = **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

|  |  |
| --- | --- |
| **A: Name the following compounds** | **B: Write the formulae for the following compounds** |
| 1) CuCl |  | 1) cobalt (II) chloride |  |
| 2) FeO |  | 2) chromium (II) oxide |  |
| 3) HgBr2 |  | 3) gold (I) chloride |  |
| 4) PbO2 |  | 4) lead (II) fluoride |  |
| 5) CrS |  | 5) copper (I) nitride |  |
| 6) FeCl3 |  | 6) tin (IV) sulphide |  |
| 7) AuI |  | 7) copper (II) sulphide |  |
| 8) Cu2O |  | 8) manganese (III) oxide |  |
| 9) PbS |  | 9) gold (III) sulphide |  |
| 10) Hg2O |  | 10) iron (III) sulphide |  |
| 11) SnF2 |  | 11) cobalt (III) oxide |  |
| 12) AuBr3 |  | 12) manganese (III) nitride |  |
| 13) CrF2 |  | 13) mercury (II) chloride |  |
| 14) MnS |  | 14) sodium iodide |  |
| 15) SnH4 |  | 15) barium chloride |  |
| 16) Fe2O3 |  | 16) potassium hydride |  |

**H. Naming Hydrates**

**Hydrate**: a solid compound that contains **water molecules**.

* + Ex. Al2O3·3H2O

|  |  |  |  |
| --- | --- | --- | --- |
| Prefix | **# of H2O molecules****or # of atoms** | Prefix | **# of H2O molecules****or # of atoms** |
| mono | 1 | hexa | 6 |
| di | 2 | hepta | 7 |
| tri | 3 | octa | 8 |
| tetra | 4 | nona | 9 |
| penta | 5 | deca | 10 |

**STEPS**

1. Name as ionic compound as you would normally do so.
2. Add prefix from table and then “hydrate”

Example’s:

1. FeSO4·5H2O = Iron (II) sulphate pentahydrate
2. NiSO4·7H2O = **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
3. Co3(PO4)2·8H2O = **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**I. Prefix Naming System:** Is used when 2 non-metals form a binary compound (covalent)

**STEPS**

1. Use prefixes from tables in front of elements
2. Second element has “ide” ending
3. Do not use mono on first elemrnt
4. Do not use Roman numerals

**Example**: Right or Wrong

Monocarbon dioxide \_\_\_\_

Carbon dioxide \_\_\_\_

Carbon (IV) dioxide \_\_\_\_

**Part A: Name the following covalent**

**compounds.**

1. CO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. CO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. N2O3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. N2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. NP \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. SCl2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. P2O5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. NBr3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. CI4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. CCl4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. PF5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. PF3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. OS \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

14. SeF2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

15. TeBr2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

16. P2S5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

17. C3N4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

18. F2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

19. CH4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

20. PH3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part B: Write the Chemical Formula for each of the following compounds.**

1. carbon tetrafluoride \_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. silicon dioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. dinitrogen trisulfide \_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. phosphorus mononitride \_\_\_\_\_\_\_\_\_\_

5. hydrogen gas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. carbon disulfide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. nitrogen trichloride \_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. silicon tetrabromide \_\_\_\_\_\_\_\_\_\_\_\_\_

9. carbon dioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. nitrogen trifluoride \_\_\_\_\_\_\_\_\_\_\_\_

11. boron trisulfide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. sulphur trioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. selenium tetrafluoride \_\_\_\_\_\_\_\_\_\_\_

14. diphosphorus pentasulfide \_\_\_\_\_\_\_

15. xenon tetrafluoride \_\_\_\_\_\_\_\_\_\_\_\_

16. sulfur dibromide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

17. carbon tetrachloride \_\_\_\_\_\_\_\_\_\_\_\_

18. oxygen gas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

19. fluorine gas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

20. dinitrogen tetroxide \_\_\_\_\_\_\_\_