

Nomenclature and Formula Writing

Ionic Compounds (metal + nonmetal)

Binary Compounds (two elements only)

- write the name of the metal (positively charged)
- then write the name of the nonmetal using the ide ending.

ex. METAL NONMETAL STEM + IDE
 NaCl sodium chloride
 MgBr₂ magnesium bromide

Compounds with Polyatomic Ions

- write the name of the metal or positively charged ion
- write the name of the complex ion

ex. METAL COMPLEX ION
 CaSO₄ calcium sulfate
 NaHCO₃ sodium bicarbonate
 or sodium hydrogen carbonate

Multivalent Metals - Compounds where the metal has more than one oxidation number

- write the name of the metal
- write the oxidation number using roman numerals in parentheses
 - or write the name with the "ic" (higher oxidation #) or "ous" (lower oxidation #) ending. Some metals use their Latin names with these endings.
- write the nonmetal or the complex ion

ex. Cu₂O copper(I) oxide or cuprous oxide CuO copper(II) oxide or cupric oxide

cupric	Cu ²⁺	ferric	Fe ³⁺	auric	Au ³⁺	plumbic	Pb ⁴⁺	stannic	Sn ⁴⁺	mercuric	Hg ²⁺
cuprous	Cu ⁺	ferrous	Fe ²⁺	aurous	Au ⁺	plumbous	Pb ²⁺	stannous	Sn ²⁺	mercurous	Hg ⁺

Molecular Compounds (Covalent Compounds) (nonmetal + nonmetal)

- because nonmetals combine in more than one ratio, we must use prefixes to indicate the number of atoms of each element in the formula.
- the following prefixes are used:
- if the prefix is followed by a vowel, the final "a" or "o" is dropped
- exception: the prefix mono is omitted for the first element only.

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

ex. N₂O dinitrogen monoxide N₂O₅ dinitrogen pentoxide CO carbon monoxide CO₂ carbon dioxide

Hydrates - Ionic Compounds

There are many compounds that crystallize from a water solution with water molecules adhering to the particles of the crystal. These hydrates, as they are called, usually contain a specific ratio of water to compound. Chemists use heat to dry these compounds and then calculate the ratio of compound to water. An example of a hydrate is NiSO₃•6H₂O. The dot shows that 6 molecules of water adhere to 1 formula unit. To name the compound, name the portion preceding the dot, followed by the prefix for the number and hydrate. The above compound would be named: NiSO₃•6H₂O nickel(II) sulfite hexahydrate

Acids

Acids are a group of compounds that are given special treatment in naming. Acids are defined in several ways, but in general, we can say that acids are compounds that give off hydrogen in water. The formula of an acid is one or more hydrogens bonded to a monatomic or polyatomic anion. The way that the acid is named is determined by the suffix of the anion.

hydrogen _____ide	becomes	hydro_____ic acid	examples:		
hydrogen _____ate	becomes	_____ic acid	HCl	hydrogen <u>chloride</u>	becomes <u>hydrochloric acid</u>
hydrogen _____ite	becomes	_____ous acid	HClO ₄	hydrogen <u>perchlorate</u>	becomes <u>perchloric acid</u>
			HClO ₃	hydrogen <u>chlorate</u>	becomes <u>chloric acid</u>
			HClO ₂	hydrogen <u>chlorite</u>	becomes <u>chlorous acid</u>
			HClO	hydrogen <u>hypochlorite</u>	becomes <u>hypochlorous acid</u>

1. Binary Ionic Compounds. Give the correct names for each of the compounds listed below.

- | | | | |
|----------------------------------|-------|------------------------------------|-------|
| a) NaCl | _____ | n) ZrS ₂ | _____ |
| b) FrBr | _____ | o) AgI | _____ |
| c) KF | _____ | p) BaSe | _____ |
| d) RaS | _____ | q) MgO | _____ |
| e) LiI | _____ | r) LaBr ₃ | _____ |
| f) Li ₃ N | _____ | s) Sr ₃ N ₂ | _____ |
| g) AlBr ₃ | _____ | t) Cd ₃ As ₂ | _____ |
| h) CdCl ₂ | _____ | u) Rb ₂ Se | _____ |
| i) K ₂ O | _____ | v) Rb ₃ N | _____ |
| j) InF ₃ | _____ | w) BaF ₂ | _____ |
| k) ZnO | _____ | x) ZrTe ₂ | _____ |
| l) Y ₂ O ₃ | _____ | y) Cs ₃ P | _____ |
| m) CaTe | _____ | z) Y ₂ O ₃ | _____ |

2. Binary Ionic Compounds. Write the correct chemical formula for each of the following compounds.

- | | | | |
|-----------------------|-------|-----------------------|-------|
| a) potassium bromide | _____ | n) potassium nitride | _____ |
| b) zinc bromide | _____ | o) aluminum bromide | _____ |
| c) lithium iodide | _____ | p) zinc phosphide | _____ |
| d) scandium chloride | _____ | q) magnesium sulfide | _____ |
| e) magnesium chloride | _____ | r) hafnium chloride | _____ |
| f) magnesium oxide | _____ | s) barium sulfide | _____ |
| g) hydrogen sulfide | _____ | t) tantalum oxide | _____ |
| h) gallium iodide | _____ | u) zirconium nitride | _____ |
| i) sodium oxide | _____ | v) potassium selenide | _____ |
| j) magnesium selenide | _____ | w) germanium fluoride | _____ |
| k) calcium fluoride | _____ | x) francium phosphide | _____ |
| l) aluminum oxide | _____ | y) zinc arsenide | _____ |
| m) beryllium chloride | _____ | z) scandium telluride | _____ |

3. Polyatomic Ions. Give the correct names for each of the compounds listed below.

- | | | | |
|---------------------------------------|-------|--|-------|
| a) CaSO_4 | _____ | n) $\text{Ta}(\text{IO}_3)_5$ | _____ |
| b) $\text{Ca}_3(\text{AsO}_4)_2$ | _____ | o) $(\text{NH}_4)_3\text{PO}_4$ | _____ |
| c) NH_4Cl | _____ | p) AgClO | _____ |
| d) $\text{Mg}_3(\text{AsO}_3)_2$ | _____ | q) KOH | _____ |
| e) $\text{NaC}_2\text{H}_3\text{O}_2$ | _____ | r) $\text{NaC}_8\text{H}_{11}\text{N}_2\text{O}_3$ | _____ |
| f) NaOCN | _____ | s) HNO_3 | _____ |
| g) $\text{Al}_2(\text{SO}_4)_3$ | _____ | t) $\text{In}(\text{VO}_3)_3$ | _____ |
| h) $\text{K}_2\text{Cr}_2\text{O}_7$ | _____ | u) Na_2HPO_3 | _____ |
| i) NH_4NO_3 | _____ | v) $\text{Ta}_2(\text{TeO}_4)_5$ | _____ |
| j) KSCN | _____ | w) $\text{Ca}(\text{NO})_2$ | _____ |
| k) $\text{Al}(\text{OH})_3$ | _____ | x) $\text{Zn}(\text{VO}_3)_2$ | _____ |
| l) MgS_2O_8 | _____ | y) $\text{Ba}(\text{OH})_2$ | _____ |
| m) NaHCO_3 | _____ | z) $\text{CaC}_8\text{H}_4\text{O}_4$ | _____ |

4. Polyatomic Ions. Write the correct chemical formula for each of the following compounds.

- | | | | |
|-----------------------------|-------|--------------------------------|-------|
| a) sodium acetate | _____ | n) silver fluoride | _____ |
| b) aluminum tetraborate | _____ | o) scandium hydroxide | _____ |
| c) calcium bromate | _____ | p) aluminum citrate | _____ |
| d) sodium silicate | _____ | q) hafnium nitrate | _____ |
| e) magnesium citrate | _____ | r) francium hydrogen oxalate | _____ |
| f) calcium tungstate | _____ | s) rubidium permanganate | _____ |
| g) potassium cyanide | _____ | t) gallium sulfite | _____ |
| h) zinc phthalate | _____ | u) ammonium dichromate | _____ |
| i) barium carbonate | _____ | v) cesium hypochlorite | _____ |
| j) indium stearate | _____ | w) sodium phosphite | _____ |
| k) calcium dichromate | _____ | x) sodium dihydrogen phosphate | _____ |
| l) yttrium tripolyphosphate | _____ | y) sodium hydrogen phosphate | _____ |
| m) zirconium bicarbonate | _____ | z) zirconium uranate | _____ |

5. Multivalent Metals. Give the correct names for each of the compounds listed below.

- | | | | |
|---|-------|---|-------|
| a) FeI_3 | _____ | n) PuPO_4 | _____ |
| b) $\text{Bi}_2(\text{SO}_4)_3$ | _____ | o) PdI_4 | _____ |
| c) FeI_2 | _____ | p) OsS_2 | _____ |
| d) HgHCO_3 | _____ | q) Co_2S_3 | _____ |
| e) NiO | _____ | r) Ti_3N_4 | _____ |
| f) $\text{Pb}(\text{H}_2\text{PO}_3)_2$ | _____ | s) MnO_2 | _____ |
| g) CuBr_2 | _____ | t) NiSO_4 | _____ |
| h) $\text{Pt}(\text{CrO}_4)_2$ | _____ | u) $\text{Ti}(\text{Cr}_2\text{O}_7)_2$ | _____ |
| i) Cr_2O_3 | _____ | v) FeSO_3 | _____ |
| j) $\text{Sb}_2(\text{SO}_5)_3$ | _____ | w) $\text{Os}(\text{NO}_3)_4$ | _____ |
| k) AuCl_3 | _____ | x) $\text{Hg}(\text{NO}_2)_2$ | _____ |
| l) $\text{Np}(\text{MnO}_3)_5$ | _____ | y) SnSO_4 | _____ |
| m) WO_3 | _____ | z) AuCl_3 | _____ |

6. Multivalent Metals. Write the correct chemical formula for each of the following compounds.

- | | | | |
|----------------------------|-------|----------------------------|-------|
| a) lead(IV) oxide | _____ | n) polonium(IV) sulfide | _____ |
| b) antimony(V) bromite | _____ | o) vanadium(V) iodate | _____ |
| c) cobalt(II) fluoride | _____ | p) plumbic phosphate | _____ |
| d) ferric thiosulfate | _____ | q) molybdenum(VI) benzoate | _____ |
| e) copper(II) cyanide | _____ | r) niobium(V) oxide | _____ |
| f) stannic tartrate | _____ | s) aurous silicate | _____ |
| g) copper(I) nitride | _____ | t) titanium(IV) sulfite | _____ |
| h) platinum(IV) dichromate | _____ | u) cobaltous chloride | _____ |
| i) nickel(II) acetate | _____ | v) samarium(III) nitrite | _____ |
| j) tin(II) peroxydisulfate | _____ | w) plumbic hydroxide | _____ |
| k) gallium(III) acetate | _____ | x) terbium (IV) periodate | _____ |
| l) gold(III) uranate | _____ | y) iridium(IV) periodate | _____ |
| m) osmium(IV) sulfite | _____ | z) stannous bicarbonate | _____ |

7. Molecular Compounds. Give the correct names for each of the compounds listed below.

- | | | | |
|--------------|-------|-------------|-------|
| a) CS_2 | _____ | i) PBr_5 | _____ |
| b) SF_2 | _____ | j) N_2O_4 | _____ |
| c) CO | _____ | k) SO_3 | _____ |
| d) ICl_3 | _____ | l) SO_2 | _____ |
| e) CCl_4 | _____ | m) N_2O_3 | _____ |
| f) As_2O_3 | _____ | n) Cl_2O | _____ |
| g) PBr_3 | _____ | o) SF_6 | _____ |
| h) IF_5 | _____ | p) SiO_2 | _____ |

8. Molecular Compounds. Write the correct chemical formula for each of the following compounds.

- | | | | |
|-----------------------------|-------|----------------------------|-------|
| a) nitrogen monoxide | _____ | i) dinitrogen tetroxide | _____ |
| b) carbon dioxide | _____ | j) diphosphorus trisulfide | _____ |
| c) iodine monochloride | _____ | k) chlorine dioxide | _____ |
| d) sulfur trioxide | _____ | l) silicon disulfide | _____ |
| e) chlorine trifluoride | _____ | m) silicon tetrafluoride | _____ |
| f) phosphorus pentachloride | _____ | n) sulfur dioxide | _____ |
| g) bromine pentafluoride | _____ | o) tricarbon disulfide | _____ |
| h) carbon tetrachloride | _____ | p) dinitrogen pentoxide | _____ |

9. Hydrates. Give the correct names for each of the compounds listed below.

- | | | | |
|------------------------------|-------|-------------------------|-------|
| a) $Li_2SiF_6 \cdot 2H_2O$ | _____ | f) $MgSO_4 \cdot 9H_2O$ | _____ |
| b) $Na_2B_4O_7 \cdot 10H_2O$ | _____ | g) $CaSO_4 \cdot 2H_2O$ | _____ |
| c) $MgSO_3 \cdot 6H_2O$ | _____ | h) $MgCl_2 \cdot 6H_2O$ | _____ |
| d) $NaC_2H_3O_2 \cdot 3H_2O$ | _____ | i) $FeSO_4 \cdot 7H_2O$ | _____ |
| e) $CuSO_4 \cdot 5H_2O$ | _____ | j) $NaHS \cdot H_2O$ | _____ |

10. Hydrates. Write the correct chemical formula for each of the following compounds.

- | | | | |
|----------------------------------|-------|--|-------|
| a) calcium chloride hexahydrate | _____ | f) plumbous acetate trihydrate | _____ |
| b) barium chloride dihydrate | _____ | g) aluminum chloride hexahydrate | _____ |
| c) calcium nitrate tetrahydrate | _____ | h) sodium dihydrogen phosphate nonahydrate | _____ |
| d) sodium chromate tetrahydrate | _____ | i) cobalt(II) nitrate hexahydrate | _____ |
| e) copper(II) nitrate trihydrate | _____ | j) cobaltous sulfate hexahydrate | _____ |

11. Acids. Give the correct formula for each of the compounds listed below.

- | | |
|----------------------------|-----------------------------|
| a) hydrochloric acid _____ | n) hydroiodic acid _____ |
| b) citric acid _____ | o) phosphoric acid _____ |
| c) benzoic acid _____ | p) nitrous acid _____ |
| d) acetic acid _____ | q) thiosulfurous acid _____ |
| e) periodic acid _____ | r) nitric acid _____ |
| f) lactic acid _____ | s) hydrotelluric acid _____ |
| g) formic acid _____ | t) hydrocyanic acid _____ |
| h) iodic acid _____ | u) hydroselenic acid _____ |
| i) oxalic acid _____ | v) nitrous acid _____ |
| j) sulfurous acid _____ | w) hypochlorous acid _____ |
| k) sulfuric acid _____ | x) hydrofluoric acid _____ |
| l) carbonic acid _____ | y) boric acid _____ |
| m) phosphorous acid _____ | z) hydrosulfuric acid _____ |

12. Acids. Write the correct name for each of the following compounds.

- | | |
|--|---|
| a) $\text{HC}_2\text{H}_3\text{O}_2(\text{aq})$ _____ | m) $\text{HC}_5\text{H}_8\text{NO}_4(\text{aq})$ _____ |
| b) $\text{H}_2\text{B}_4\text{O}_7(\text{aq})$ _____ | n) $\text{H}_3\text{PO}_4(\text{aq})$ _____ |
| c) $\text{H}_3\text{AsO}_3(\text{aq})$ _____ | o) $\text{HClO}(\text{aq})$ _____ |
| d) $\text{HI}(\text{aq})$ _____ | p) $\text{HBr}(\text{aq})$ _____ |
| e) $\text{H}_3\text{BO}_3(\text{aq})$ _____ | q) $\text{H}_2\text{C}_2\text{O}_4(\text{aq})$ _____ |
| f) $\text{HF}(\text{aq})$ _____ | r) $\text{H}_2\text{CO}_3(\text{aq})$ _____ |
| g) $\text{HCNO}(\text{aq})$ _____ | s) $\text{H}_2\text{SiO}_2(\text{aq})$ _____ |
| h) $\text{H}_2\text{SO}_4(\text{aq})$ _____ | t) $\text{HFO}_2(\text{aq})$ _____ |
| i) $\text{H}_2\text{C}_4\text{H}_4\text{O}_6(\text{aq})$ _____ | u) $\text{HC}_{17}\text{H}_{35}\text{COO}(\text{aq})$ _____ |
| j) $\text{HCN}(\text{aq})$ _____ | v) $\text{H}_3\text{PO}_3(\text{aq})$ _____ |
| k) $\text{H}(\text{HCOO})(\text{aq})$ _____ | w) $\text{HCl}(\text{aq})$ _____ |
| l) $\text{HNO}_3(\text{aq})$ _____ | x) $\text{HBrO}_2(\text{aq})$ _____ |

A. Review. Give the correct chemical formula for each of the following compounds.

- | | | | |
|--------------------------------|-------|----------------------------------|-------|
| 1. sodium hydroxide | _____ | 35. nickel(II) peracetate | _____ |
| 2. copper(II) sulfide | _____ | 36. mercuric chloride dihydrate | _____ |
| 3. potassium phosphide | _____ | 37. dinitrogen trioxide | _____ |
| 4. ozone | _____ | 38. sodium hypoiodite | _____ |
| 5. lithium nitride | _____ | 39. potassium cyanide | _____ |
| 6. lithium hydride | _____ | 40. potassium aluminum sulfate | _____ |
| 7. magnesium percarbonate | _____ | 41. ammonium hypophosphite | _____ |
| 8. aluminum sulfite | _____ | 42. potassium uranate | _____ |
| 9. sodium sulfate heptahydrate | _____ | 43. lithium peroxide | _____ |
| 10. sodium carbonite | _____ | 44. perchloric acid | _____ |
| 11. perchloric acid | _____ | 45. ammonia | _____ |
| 12. calcium hyponitrite | _____ | 46. iodous acid | _____ |
| 13. nitrous acid | _____ | 47. hydrogen peroxide | _____ |
| 14. sulfurous acid | _____ | 48. gold(III) periodate | _____ |
| 15. zinc acetate trihydrate | _____ | 49. sodium oxide | _____ |
| 16. potassium hypochromite | _____ | 50. sodium glutamate | _____ |
| 17. barium nitride | _____ | 51. iron(II) sulfate | _____ |
| 18. cobalt(II) perphosphate | _____ | 52. barium perchlorate | _____ |
| 19. carbon dioxide | _____ | 53. manganese(II) nitrate | _____ |
| 20. sulfuric acid | _____ | 54. osmium(IV) thiosulfate | _____ |
| 21. iron(III) chloride | _____ | 55. chromium(III) nitrate | _____ |
| 22. chromium(III) acetate | _____ | 56. boric acid | _____ |
| 23. hydrobromic acid | _____ | 57. rubidium acetate | _____ |
| 24. silver carbonate | _____ | 58. hypoiodous acid | _____ |
| 25. hydrogen bromide | _____ | 59. cerium(III) phosphate | _____ |
| 26. barium chloride | _____ | 60. nitrous acid | _____ |
| 27. boron trifluoride | _____ | 61. chromium(III) nitride | _____ |
| 28. calcium hydroxide | _____ | 62. nitric acid | _____ |
| 29. calcium hydride | _____ | 63. magnesium nitrate | _____ |
| 30. lead(II) hyposulfite | _____ | 64. hypoiodous acid | _____ |
| 31. hypophosphorous acid | _____ | 65. copper(II) tartrate | _____ |
| 32. carbonic acid | _____ | 66. arsenous acid | _____ |
| 33. beryllium perchlorate | _____ | 67. magnesium hexafluorosilicate | _____ |
| 34. ferrous hydroxide | _____ | 68. cyanic acid | _____ |

B. Review. Give the correct names for each of the compounds listed below.

- | | | | |
|--------------------------------------|-------|---|-------|
| 1. SnO_2 | _____ | 35. Na_3PO_4 | _____ |
| 2. Sb_2S_3 | _____ | 36. Na_2CrO_4 | _____ |
| 3. HgS | _____ | 37. LiClO_4 | _____ |
| 4. MoS_2 | _____ | 38. $\text{Zn}(\text{C}_2\text{H}_3\text{O})_2$ | _____ |
| 5. FeS | _____ | 39. $\text{Au}(\text{CN})_3$ | _____ |
| 6. HgO | _____ | 40. K_2CrO_4 | _____ |
| 7. AuCl_3 | _____ | 41. KHCO_3 | _____ |
| 8. NiBr_2 | _____ | 42. $\text{Mn}(\text{OH})_2$ | _____ |
| 9. MgO | _____ | 43. $\text{Ba}(\text{SCN})_2$ | _____ |
| 10. NaBr | _____ | 44. RbCN | _____ |
| 11. Al_2O_3 | _____ | 45. NaBrO | _____ |
| 12. CaO | _____ | 46. $\text{Al}_2(\text{SO}_5)_3$ | _____ |
| 13. Ag_2S | _____ | 47. $\text{Fe}(\text{ClO})_2$ | _____ |
| 14. CaH_2 | _____ | 48. $(\text{NH}_4)_2\text{CO}_3$ | _____ |
| 15. K_2CO_3 | _____ | 49. $\text{Zn}(\text{NO}_2)_2$ | _____ |
| 16. $(\text{NH}_4)_2\text{S}$ | _____ | 50. $\text{Ca}(\text{NO}_3)_2$ | _____ |
| 17. $\text{Cr}(\text{NO}_3)_2$ | _____ | 51. NH_4OH | _____ |
| 18. KMnO_4 | _____ | 52. NiPO_2 | _____ |
| 19. SO_3 | _____ | 53. NH_3 | _____ |
| 20. P_2S_5 | _____ | 54. CaSO_4 | _____ |
| 21. As_2S_3 | _____ | 55. $\text{Pb}(\text{HSO}_4)_4$ | _____ |
| 22. CCl_4 | _____ | 56. $\text{Ca}(\text{ClO}_3)_2$ | _____ |
| 23. N_2O_4 | _____ | 57. AlPO_4 | _____ |
| 24. NO | _____ | 58. Li_2CO_2 | _____ |
| 25. H_3BO_3 | _____ | 59. PCl_5 | _____ |
| 26. MgSCN | _____ | 60. $\text{Mg}(\text{NO}_3)_2$ | _____ |
| 27. HNO_2 | _____ | 61. SO_2 | _____ |
| 28. As_2S_5 | _____ | 62. BaCr_2O_7 | _____ |
| 29. H_3PO_4 | _____ | 63. SrH_2 | _____ |
| 30. $\text{Fe}(\text{NO}_3)_2$ | _____ | 64. H_2SO_4 | _____ |
| 31. H_3AsO_3 | _____ | 65. Na_2O_2 | _____ |
| 32. Cu_2SO_4 | _____ | 66. CsH_2PO_4 | _____ |
| 33. HIO_3 | _____ | 67. $\text{Pb}_3(\text{PO}_3)_2$ | _____ |
| 34. $\text{K}_2\text{C}_2\text{O}_4$ | _____ | 68. $\text{HBr}(\text{aq})$ | _____ |