

Lecture 4

Nomenclature

Naming Ionic Compounds
Naming Covalent Compounds
Naming Acids
Naming Hydrates

Naming Binary Ionic Compounds

- The positive ion (cation) is written first.
 - Takes the same name as the element.
 - The negative ion (anion) is written last.
 - Takes the first part of its elements name, and **-ide** is added to the end.
- Ex) Bromine is changed to Bromide.

Naming Binary Ionic Compounds

- You need to know if an element forms cations with different charges.
- If it does, you need to specify the charge in roman numerals.
- Ex) CuS is written as Copper(II) Sulfide
- Sulfide has to be S^{2-}
- Copper must be Cu^{2+} to make the compound neutral

Naming Binary Ionic Compounds

Ex) CuBr is written as Copper (I) Bromide.

- Bromide has to be Br^{-}
- Copper must be Cu^{1+} to make the compound neutral.

Ex) Fe_2O_3 is written as Iron (III) Oxide.

- Oxide has to be O^{2-}
- As there are three of them, they make up a charge of 6-
- The two Irons must combine to form a charge of 6+
- Thus each of them must carry a charge of 3+

Naming Binary Ionic Compounds

- 1) LiF
- 2) $CaBr_2$
- 3) K_2S
- 4) FeS
- 5) MgO
- 6) MnO
- 7) CoI_3

Naming Compounds with Polyatomic Ions

- For polyatomic ions, always use the name assigned to it.
 - You don't add an additional suffix such as **-ide**.
 - Ex) CO_3^{2-} is the carbonate ion.
 - $CaCO_3$ is calcium carbonate

Naming Compounds with Polyatomic Ions

- Ammonium (NH_4^+) is the only polyatomic cation you need to know.

– Ex) NH_4Cl is ammonium chloride

– Ex) NO_3^- is the nitrate ion

- NH_4NO_3 is ammonium nitrate

Hints for learning the names of polyatomic ions

- Polyatomic ions ending in –ide.
 - Only three polyatomic ions end in –ide.
 - CN^- *Cyanide*
 - OH^- *Hydroxide*
 - O_2^{2-} *Peroxide*

Everything else ending in –ide is a monoatomic anion.

Hints for learning the names of polyatomic ions

- A system for oxoanions.
 - Hypo-___-ite (2 less oxygens than ___-ate)
 - ___-ite (1 less oxygen than ___-ate)
 - ___-ate
 - Per-___-ate (1 more oxygen than ___-ate)
- All polyatomic ions in such a series carry the same charge.

Hints for learning the names of polyatomic ions

- A system for oxoanions.
- The example of Chlorate (ClO_3^-)
 - *Hypochlorite* ClO^- (2 less oxygens than ___-ate)
 - *Chlorite* ClO_2^- (1 less oxygen than ___-ate)
 - *Chlorate* ClO_3^-
 - *Perchlorate* ClO_4^- (1 more oxygen than ___-ate)

Hints for learning the names of polyatomic ions

- A system for oxoanions.
- The example of Sulfate (SO_4^{2-})
 - *Sulfite* SO_3^{2-} (1 less oxygen than ___-ate)
 - *Sulfate* SO_4^{2-}
- There is no *hypo-___-ite* or *per-___-ate* for sulfate.

Naming Compounds with Polyatomic Ions

- 1) CuCO_3
- 2) K_2SO_3
- 3) $\text{Ca}(\text{ClO})_2$
- 4) KClO_4
- 5) NaClO_3
- 6) LiNO_2
- 7) LiNO_3
- 8) NaCH_3COO

Recognizing Ionic Compounds

- Ionic compounds contain either a metal and a non-metal, or polyatomic ions.
- If the first word in the compound is a metal or ammonium, it is an ionic compound.

Writing Ionic Formulas

- Ionic compounds are neutral.
 - Thus, all charges must sum up to zero.
- Charges come from the associated group in the periodic table, or a list.
- Parenthesis must be used when there is some multiple of a certain polyatomic ion.

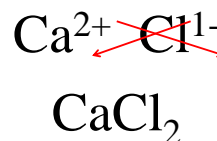
Writing Ionic Formulas

Ex1) Calcium Chloride

- Calcium is always 2+ (group 2A periodic table)
- -ide in chloride tells you it is monoatomic
 - Chloride is always 1- (group 7A periodic table)

Writing Ionic Formulas

Criss-Cross Method



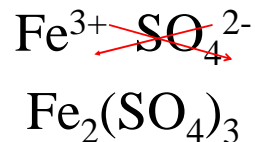
Writing Ionic Formulas

Ex 2) Iron (III) Sulfate

- You know Iron is 3+ from the roman numeral.
- You know that Sulfate is SO_4^{2-} because you memorized the table of polyatomic ions.

Writing Ionic Formulas

Criss-Cross Method



Writing Ionic Formulas

- 1) Aluminum hydrogen sulfate
- 2) Iron (II) oxide
- 3) Iron (III) oxide
- 4) Strontium chromate
- 5) Potassium chloride
- 6) Ammonium Nitrate
- 7) Lithium Sulfite

Recognizing Binary Covalent Compounds

- They are made of two non-metals

Naming Binary Covalent Compounds

- Two words with prefixes
 - mono (1), di (2), tri (3), tetra (4), penta (5), hexa (6), hepta (7), octa (8), nona (9), deca (10)
- First word takes the name of the element with the suitable prefix
 - The prefix *mono-* is not used when there is only one atom in the first element.
- Second word takes the name of the element with the -ide suffix and the suitable prefix

Naming Binary Covalent Compounds

- 1) SiO₂
- 2) CO
- 3) CF₄
- 4) N₄O₄
- 5) XeF₆
- 6) N₂O₃
- 7) P₄O₇

Naming Binary Covalent Compounds

- 1) Carbon dioxide
- 2) Phosphorus trichloride
- 3) Sulfur tetrafluoride
- 4) Disulfur dichloride
- 5) Iodine monochloride
- 6) Dinitrogen tetraoxide
- 7) Nitrogen triiodide

Recognizing Acids

- Formulas for acids usually start with H
 - Hydrogen is always the cation.
 - The cation is often written at the end of organic acids.
 - CH₃COOH (acetic acid)
- There are two types of acids that we will look at
 - Acids that contain Oxygen
 - Acids that do not contain Oxygen

Naming Oxygen Containing Acids

- To name all acids you must look at the anion.
- Oxygen containing acids have polyatomic anions.
- Write the name of the polyatomic anion but change:
 - ate to -ic ,or
 - ite to -ous
 and add the word **acid**.

Naming Oxygen Containing Acids

Formula	Polyatomic Ion	Acid's Name
HClO ₄	Perchlorate	Perchloric acid
H ₂ SO ₄	Sulfate	Sulfuric acid
CH ₃ COOH	Acetate	Acetic acid
H ₂ SO ₃	Sulfite	Sulfurous acid
HNO ₂	Nitrite	Nitrous acid

Naming Non-Oxygen Containing Acids

- Non-oxygen containing acids have monoatomic or polyatomic anions.
- Write the name of the anion but
 - change -ide to -ic
 - Add the prefix **hydro-** and the word **acid**.

Naming Non-Oxygen Containing Acids

Formula	Ion's Name	Acid's Name
HCN	Cyanide	Hydrocyanic acid
HCl	Chloride	Hydrochloric acid
HBr	Bromide	Hydrobromic acid

Naming acids

- Nitric acid
- Phosphoric acid
- Hydrofluoric acid
- Hydrophosphoric acid
- Carbonic acid
- Hypochlorous acid

Hydrates

- Hydrates are ionic compounds that trap water within their structures.
- Both the name and the chemical formula specify how much water is contained within the structure.

Writing Formulas for Hydrates

- Write the formula for the ionic compound using the rules you learned earlier.
- Add a dot and the correct number of waters taken from the prefix.

Ex) Sodium sulfate decahydrate



Writing Formulas for Hydrates

1) Barium Chloride Dihydrate

2) $\text{FeCl}_3 \cdot 6 \text{H}_2\text{O}$