Chemical Nomenclature

Nomenclature is essential to our understanding and use of chemistry. **This is one topic that you should have learned in your high school chemistry and that you will be held responsible for, in spite of the fact that I’m not covering it in lecture.** Summarized below are the basic rules YOU SHOULD ALREADY KNOW for naming chemical compounds. You should also read about this in Chapter 2 of your text if you’re lost, paying particular attention to tables 2.3, 2.4 & 2.5. **Any of the ions listed on these tables are fair game. Most of these ions are listed on the table on the next page. YOU MUST KNOW THESE RULES or you will find yourself lost and hurting for the entire term. That means nomenclature will show up on quizzes and exams throughout the term.** See me for clarification and assistance. Attached at the end is a worksheet for you to practice on.

**Nomenclature review:**

Ionic compounds (metal and non-metal)

**Fundamental Rules:**
- Formula must reflect electroneutrality
- Name (and write) metal first
- Indicate charge on variable metals using Roman numerals in parentheses

A. binary (composed of two types of atoms, usually a metal and a non-metal)
B. polyatomic (composed of more than two types of atoms)

common metal ions you can count on:
IA, IIA, IIIA metals, +1, +2, +3
NH₄⁺ (ammonium ion), Zn²⁺, Ni²⁺, Cd²⁺, Ag⁺

common monoatomic anions:
F⁻ fluoride
Cl⁻ chloride
Br⁻ bromide
I⁻ iodide
O²⁻ oxide
S²⁻ sulfide

common polyatomic anions
OH⁻ hydroxide
NO₃⁻ nitrate
NO₂⁻ nitrite
CO₃²⁻ carbonate
SO₄²⁻ sulfate
SO₃²⁻ sulfite
PO₄³⁻ phosphate
C₂H₃O₂⁻ acetate
ClO₃⁻ chlorate

Covalent compounds (non-metals)

**Fundamental Rules:**
- Formula must reflect electroneutrality
- Name (and write) more electropositive element first
- More electronegative element name ends in -ide
- Indicate number of each element with Greek prefixes, except when redundant

one mono, mon (before vowels)
two di
three tri
four tetra
five penta, pent (before vowels)
six hexa
seven hepta
eight octa
nine nona
ten deca

examples:
CO₂ carbon dioxide
CO carbon monoxide
HCl hydrogen chloride
H₂S hydrogen sulfide
P₂O₅ diphosphorus pentoxide
SF₆ sulfur hexafluoride
## Common Ions and Acids

Below is a list of the common ion and acid names I expect you to know for quizzes & exams. Learn these now or lose points all term…! The more important ones are in bold.

<table>
<thead>
<tr>
<th>Common Cations</th>
<th>Common Anions</th>
<th>Common Acids</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Always +1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li⁺¹</td>
<td>F⁻</td>
<td>HF</td>
</tr>
<tr>
<td>Na⁺¹</td>
<td>Cl⁻</td>
<td>HCl</td>
</tr>
<tr>
<td>K⁺¹</td>
<td>Br⁻</td>
<td>HBr</td>
</tr>
<tr>
<td>Ag⁺¹</td>
<td>I⁻</td>
<td>HI</td>
</tr>
<tr>
<td>NH₄⁺¹</td>
<td>OH⁻</td>
<td></td>
</tr>
<tr>
<td><strong>Always +2</strong></td>
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<td></td>
</tr>
<tr>
<td>Mg⁺²</td>
<td>CN⁻</td>
<td>HCN</td>
</tr>
<tr>
<td>Ca⁺²</td>
<td>OCN⁻</td>
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</tr>
<tr>
<td>Sr⁺²</td>
<td>SCN⁻</td>
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</tr>
<tr>
<td>Ba⁺²</td>
<td>ClO₄⁻</td>
<td>HClO₄</td>
</tr>
<tr>
<td>Zn⁺²</td>
<td>ClO₃⁻</td>
<td>HClO₃</td>
</tr>
<tr>
<td>Cd⁺²</td>
<td>ClO₂⁻</td>
<td>HClO₂</td>
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<tr>
<td><strong>Always +3</strong></td>
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<tr>
<td>Al⁺³</td>
<td>NO₃⁻</td>
<td>HNO₃</td>
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<tr>
<td><strong>Variable</strong></td>
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<tr>
<td>Cr⁺²</td>
<td>SO₄⁻</td>
<td>H₂SO₄</td>
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<tr>
<td>Cr⁺³</td>
<td>SO₃⁻</td>
<td>H₂SO₃</td>
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<tr>
<td>Co⁺²</td>
<td>C₂O₄⁻²</td>
<td>H₂C₂O₄</td>
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<tr>
<td>Co⁺³</td>
<td>CrO₄⁻²</td>
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<tr>
<td>Fe⁺²</td>
<td>O₂⁻²</td>
<td>H₂S</td>
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<tr>
<td>Fe⁺³</td>
<td>O⁻²</td>
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</tr>
<tr>
<td>Cu⁺¹</td>
<td>NO₂⁻</td>
<td>HNO₂</td>
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<tr>
<td>Cu⁺²</td>
<td>S⁻²</td>
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<tr>
<td>Sn⁺²</td>
<td>CrO₃⁻</td>
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<tr>
<td>Sn⁺⁴</td>
<td>Cr₂O₇⁻²</td>
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<tr>
<td>Pb⁺²</td>
<td>SO₄⁻²</td>
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<tr>
<td>Pb⁺⁴</td>
<td>H₂SO₄</td>
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<tr>
<td>Hg₂⁺²</td>
<td>N³⁻</td>
<td></td>
</tr>
<tr>
<td>Hg⁺²</td>
<td>P³⁻</td>
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<tr>
<td><strong>Always -2</strong></td>
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<tr>
<td>MnO₄⁻</td>
<td>CrO₄⁻²</td>
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<tr>
<td><strong>Always -3</strong></td>
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<tr>
<td>PO₄⁻³</td>
<td>PbO₂⁻²</td>
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</table>

- **Hydrofluoric acid**
- **Hydrochloric acid**
- **Hydrobromic acid**
- **Hydriodic acid**
- **Perchloric acid**
- **Chloric acid**
- **Chlorous acid**
- **Hypochlorous acid**
- **Nitric acid**
- **Nitrous acid**
- **Acetic acid**
- **Hydrosulfuric acid**
- **Sulfuric acid**
- **Sulfurous acid**
- **Oxalic acid**
- **Phosphoric acid**
Nomenclature Practice:
1. Name the following ionic compounds. Remember to include Roman Numerals for transition metals:
   (a) K$_2$O ______________________________
   (b) MgH$_2$ ______________________________
   (c) Na$_3$N ______________________________
   (d) BeBr$_2$ ______________________________
   (e) CaO _________________________________
   (f) AgI _________________________________
   (g) CuF$_2$ ______________________________
   (h) Fe$_2$O$_3$ ______________________________
   (i) CrCl$_3$ ______________________________
   (j) Al$_3$S$_2$ ______________________________

2. Write formulas for the following ionic compounds:
   (a) Barium chloride____________________ (e) Aluminum nitride____________________
   (b) Sodium selenide____________________ (f) Copper(II) sulfide _________________
   (c) Potassium phosphide________________ (g) Calcium nitride _____________________
   (d) Manganese(IV) oxide_________________ (h) Aluminum hydride __________________

3. Name the following ionic compounds which include polyatomic ions:
   (a) LiNO$_3$ ______________________________
   (b) K$_3$PO$_4$ ______________________________
   (c) CuSO$_4$ ______________________________
   (d) NH$_4$NO$_3$ ____________________________
   (e) NaH$_2$PO$_4$ __________________________
   (f) Sn(ClO$_3$)$_2$ _________________________
   (g) Fe$_2$(CO$_3$)$_3$ ________________________
4. Name the following molecular compounds:
   (a) P$_2$O$_5$ ________________________
   (b) SO$_2$ ________________________
   (c) N$_2$O ________________________
   (d) P$_4$O$_7$ ________________________
   (e) SF$_4$ ________________________
   (f) N$_2$O$_3$ ________________________
   (g) S$_2$Cl$_2$ ________________________

5. Give formulas for the following molecular compounds:
   (a) Nitrogen triiodide ________________________
   (b) Iodine monochloride ________________________
   (c) Carbon monoxide ________________________
   (d) Tetraphosphorus hexoxide ________________________
   (e) Disulfur difluoride ________________________
   (f) Sulfur hexafluoride ________________________