

1. Nomenclature of Ionic Compounds.

A) Naming Simple Cations

Simple cations are formed by removal of one or more electrons from a single atom.

Eg. Na^+ , Mg^{+2} , Cr^{+3} , etc.

The name of a simple cation consists of (1) the name of the element, (2) the charge on the cation written inside parentheses as a Roman numeral, and (3) the word "ion".

Eg. Cr^{+3} chromium(III) ion Fe^{+2} iron(II) ion Fe^{+3} iron(III) ion

Some elements form only a single type of cation. These elements are:

- the IA metals, Li to Fr (all of which form only +1 ions);
- the IIA metals, Be to Ra (all of which form only +2 ions);
- and the elements Al (forms +3 ions only) and Zn (forms +2 ions only).

For elements that form only a single type of cation, the Roman numeral and parentheses are omitted and the element name and the word "ion" are used.

Eg. Na^+ sodium ion Mg^{+2} magnesium ion Al^{+3} aluminum ion

B) Naming Pseudo-Simple Cations

There are a number of cations that contain more than a single atom yet behave in a manner very similar to some simple cations. These pseudo-simple cations are named as if they were in fact simple cations.

You need to memorize: H_3O^+ hydronium ion NH_4^+ ammonium ion

C) Naming Simple Anions

Simple anions are formed by the addition of one or more electrons to a single atom.

Eg. F^- , O^{-2} , N^{-3} , etc.

The name of a simple anion consists of (1) the root of the element name modified by the ending, (2) the ending "ide", and (3) the word "ion".

Eg. N^{-3} nitride ion O^{-2} oxide ion F^- fluoride ion

Each nonmetal element forms only a single type of **simple anion** and therefore, it is not necessary to include the charge in the name. It is necessary, however, to be familiar with the type of anion that each family forms.

FAMILY NUMBER

VA	VIA	VIIA
- 3	- 2	- 1

D) Naming Pseudo-Simple Anions

Although a little more complex structurally than simple anions, pseudo-simple anions are named in the same manner. That is, with the "ide" ending.

You need to memorize:

OH^- hydroxide ion	CN^- cyanide ion
NH_2^- amide ion	O_2^{-2} peroxide ion
N_3^- azide ion	

E) Naming Complex Anions

These anions have a central atom surrounded by some number of oxygen atoms. Because of this, they are often referred to as "oxoanions". The method used to name these anions is too complex for discussion at this time and therefore we must rely on memorization instead. The complex anions that you should become familiar with are (i.e., memorize):

NO_2^-	nitrite ion	SO_3^{2-}	sulfite ion	PO_3^{3-}	phosphite ion
NO_3^-	nitrate ion	SO_4^{2-}	sulfate ion	PO_4^{3-}	phosphate ion
		HSO_4^-	hydrogen sulfate ion	HPO_4^{2-}	hydrogen phosphate ion
ClO^-	hypochlorite ion			H_2PO_4^-	dihydrogen phosphate ion
ClO_2^-	chlorite ion	CO_3^{2-}	carbonate ion		
ClO_3^-	chlorate ion	HCO_3^-	hydrogen carbonate ion		
ClO_4^-	perchlorate ion				

F) Naming Ionic Compounds

The name of an ionic compound consists of (1) the name of the cation followed by (2) the name of the anion. The word "ion" is omitted from the ion names.

Eg.	$\text{Cu}(\text{NO}_3)_2$	copper(II) nitrate	Na_2HPO_4	sodium hydrogenphosphate
	FeO	iron(II) oxide	Fe_2O_3	iron(III) oxide

2. Nomenclature of Binary Molecular Compounds.

A binary molecular compounds contains atoms of only **two** elements. The system for naming such compounds is based on the use of prefixes.

<u>Number of Atoms in Formula</u>	<u>Prefix</u>
1	---
2	di
3	tri
4	tetra
5	penta
6	hexa
7	hepta
8	octa
9	nona
10	deca
11	undeca
12	dodeca

The name of binary molecular compounds consists of (1) the appropriate prefix to indicate the number of atoms of the first element in the formula, (2) the name of the first element, (3) the appropriate prefix to indicate the number of atoms of the second element in the formula, (4) the root of the name of the second element modified by (5) the ending "ide".

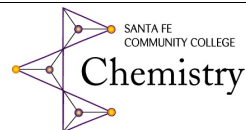
Eg.	N_2O_3	dinitrogen trioxide*	P_4S_6	tetraphosphorus hexasulfide
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* Note: When the second element is oxygen the "a" on the end of the prefix is omitted.

Eg.	N_2O_5	is dinitrogen pentoxide and NOT dinitrogen pent a oxide.
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Simple Nomenclature Homework



1. Name the following cations.

- | | | | | |
|---------------------|---------------------|---------------------|----------------------|---------------------|
| a) Ca^{+2} | b) Li^{+} | c) Fe^{+3} | d) Ga^{+} | e) Cu^{+2} |
| f) Ag^{+} | g) Ti^{+2} | h) V^{+2} | i) NH_4^{+} | j) Zn^{+2} |

2. Give the formula for the following cations.

- | | | |
|-----------------------|----------------------|------------------|
| a) manganese(III) ion | b) hydronium ion | c) beryllium ion |
| d) cobalt(II) ion | e) scandium(III) ion | f) zinc ion |

3. Name the following anions.

- | | | | | |
|-----------------------|----------------------|-----------------------|-----------------------|--------------------|
| a) OH^{-} | b) S^{-2} | c) P^{-3} | d) H^{-} | e) Cl^{-} |
| f) CO_3^{-2} | g) NO_3^{-} | h) SO_4^{-2} | i) PO_4^{-3} | j) I^{-} |

4. Give the formulas for the following anions.

- | | | |
|----------------|-----------------|-----------------|
| a) amide ion | b) sulfite ion | c) oxide ion |
| d) nitride ion | e) arsenide ion | f) fluoride ion |

5. Name the following ionic compounds.

- | | | | | |
|-------------------|---------------------|---------------------------------|--------------------------|---------------------------|
| a) LiCN | b) NaHSO_4 | c) AlPO_3 | d) FeO | e) CuF_2 |
| f) VCl_3 | g) MnI_2 | h) $\text{Cr}_2(\text{SO}_4)_3$ | i) K_2Se | j) NH_4Br |

6. Give the formulas for the following ionic compounds.

- | | | |
|------------------------|--------------------------------|--------------------------|
| a) aluminum sulfate | b) ammonium carbonate | c) chromium(III) sulfide |
| d) chromium(III) oxide | e) calcium dihydrogenphosphate | f) nickel(II) hydroxide |

7. Name the following molecules.

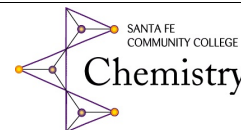
- | | | | | |
|-------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| a) CO_2 | b) S_4N_4 | c) IF_7 | d) SF_6 | e) N_2O_5 |
| f) Se_2F_{10} | g) SO_3 | h) P_4S_8 | i) I_4O_9 | j) BF_3 |

8. Give the formulas for the following molecular compounds.

- | | | |
|-----------------------------|--------------------------|-----------------------------|
| a) carbon disulfide | b) bromine pentafluoride | c) dinitrogen tetroxide |
| d) phosphorus pentachloride | e) iodine tribromide | f) tetraphosphorus hexoxide |



Simple Nomenclature Answer Key



1. See "SIMPLE NOMENCLATURE" section 1 A & B.

- a) calcium ion * b) lithium ion * c) iron(III) ion d) gallium(I) ion e) copper(II) ion
f) silver(I) ion g) titanium(II) ion h) vanadium(II) ion i) ammonium ion ** j) zinc ion*

* Note: These elements form only a single type of cation so the roman numeral and parentheses are omitted.

** Note: This is a pseudo-simple cation the name and formula of which must be memorized.

2. See "SIMPLE NOMENCLATURE" section 1 A & B.

- a) Mn^{+3} b) H_3O^+ * c) Be^{+2}
d) Co^{+2} e) Sc^{+3} f) Zn^{+2}

* Note: This is a pseudo-simple cation the name and formula of which must be memorized.

3. See "SIMPLE NOMENCLATURE" section 1 C, D & E.

- a) hydroxide ion * b) sulfide ion c) phosphide ion d) hydride ion e) chloride ion
f) carbonate ion ** g) nitrate ion ** h) sulfate ion ** i) phosphate ion ** j) iodide ion

* Note: This is a pseudo-simple anion the name and formula of which must be memorized.

** Note: These are complex anions the names and formulas of which must be memorized.

4. See "SIMPLE NOMENCLATURE" section 1 C, D & E.

- a) NH_2^- * b) SO_3^{-2} ** c) O^{-2}
d) N^{-3} e) As^{-3} f) F^-

* Note: This is a pseudo-simple anion the name and formula of which must be memorized.

** Note: This is a complex anion the name and formula of which must be memorized.

5. See "SIMPLE NOMENCLATURE" section 1 C, D & E.

- a) lithium cyanide * b) sodium hydrogen sulfate ** c) aluminum phosphite **
d) iron(II) oxide e) copper(II) fluoride f) vanadium(III) chloride
g) manganese(II) iodide h) chromium(III) sulfate ** i) potassium selenide
j) ammonium bromide *

* Note: These salts contain a pseudo-simple ions the names and formulas of which must be memorized.

** Note: These salts contain complex anions the names and formulas of which must be memorized.

6. See "SIMPLE NOMENCLATURE" section 1 C, D & E.

- a) $\text{Al}_2(\text{SO}_4)_3$ * b) $(\text{NH}_4)_2\text{CO}_3$ ** c) Cr_2S_3
d) Cr_2O_3 e) $\text{Ca}(\text{H}_2\text{PO}_4)_2$ * f) $\text{Ni}(\text{OH})_2$ ***

* Note: These salts contain complex anions the names and formulas of which must be memorized.

** Note: This salt contains a complex anion and a pseudo-simple cation the name and formula of which must be memorized.

*** Note: This salt contains a pseudo-simple ion the name and formula of which must be memorized.

7. See "SIMPLE NOMENCLATURE" section 2.

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|------------------------|--------------------------------|----------------------------|
| a) carbon dioxide | b) tetrasulfur tetranitride | c) iodine heptafluoride |
| d) sulfur hexafluoride | e) dinitrogen pentoxide | f) diselenium decafluoride |
| g) sulfur trioxide | h) tetraphosphorus octasulfide | i) tetraiodine nonoxide |
| j) boron trifluoride | | |

8. See "SIMPLE NOMENCLATURE" section 2.

- | | | |
|-------------------|-------------------|---------------------------|
| a) CS_2 | b) BrF_5 | c) N_2O_4 |
| d) PCl_5 | e) IBr_3 | f) P_4O_6 |