Part B Naming & Formula of Ionic Compounds

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PART B: NAMING & FORMULA OF IONIC COMPOUNDS

- Ionic compounds are ALWAYS made up of a metal and a non-metal (and are always written in that order). (salt)
- Recall the first ionic compound example we did: **sodium and chlorine.**
  - sodium donated an electron to chlorine so that they both had full valence shells
  - The Na^+ and Cl^- ions are attracted to each other forming an ionic bond.
  - To name the new compound formed, the positive metal ions keep their name: (both Na and Na^+ are called sodium).
  - negative non-metal ions' endings change to IDE (Cl is called chlorine and Cl^- is called chloride).
  - So, the compound is called sodium chloride

Na^+ = sodium ion

Cl^- = chloride

metal keeps name

non-metal changes to "-ide"

What makes up an ionic compound?

metal + non-metal

What is happening with the electrons of the atoms involved?

$Na^+ \xrightarrow{e^-} Cl^-$

e⁻ are transferred.

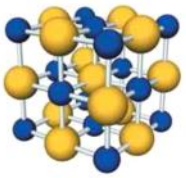

Figure 4.19 The arrangement of ions in sodium chloride

Cl^- Na^+

1. FROM CHEMICAL FORMULA --> COMPOUND NAME

Step 1: name the metal ion 1st

Step 2: name the non-metal ion, change the ending to "-ide"

Ions of Non-metals

Element	Ion	Symbol
fluorine	fluoride	F^-
chlorine	chloride	Cl^-
bromine	bromide	Br^-
iodine	iodide	I^-
oxygen	oxide	O^{2-}
sulfur	sulfide	S^{2-}
selenium	selenide	Se^{2-}
nitrogen	nitride	N^{3-}
phosphorus	phosphide	P^{3-}

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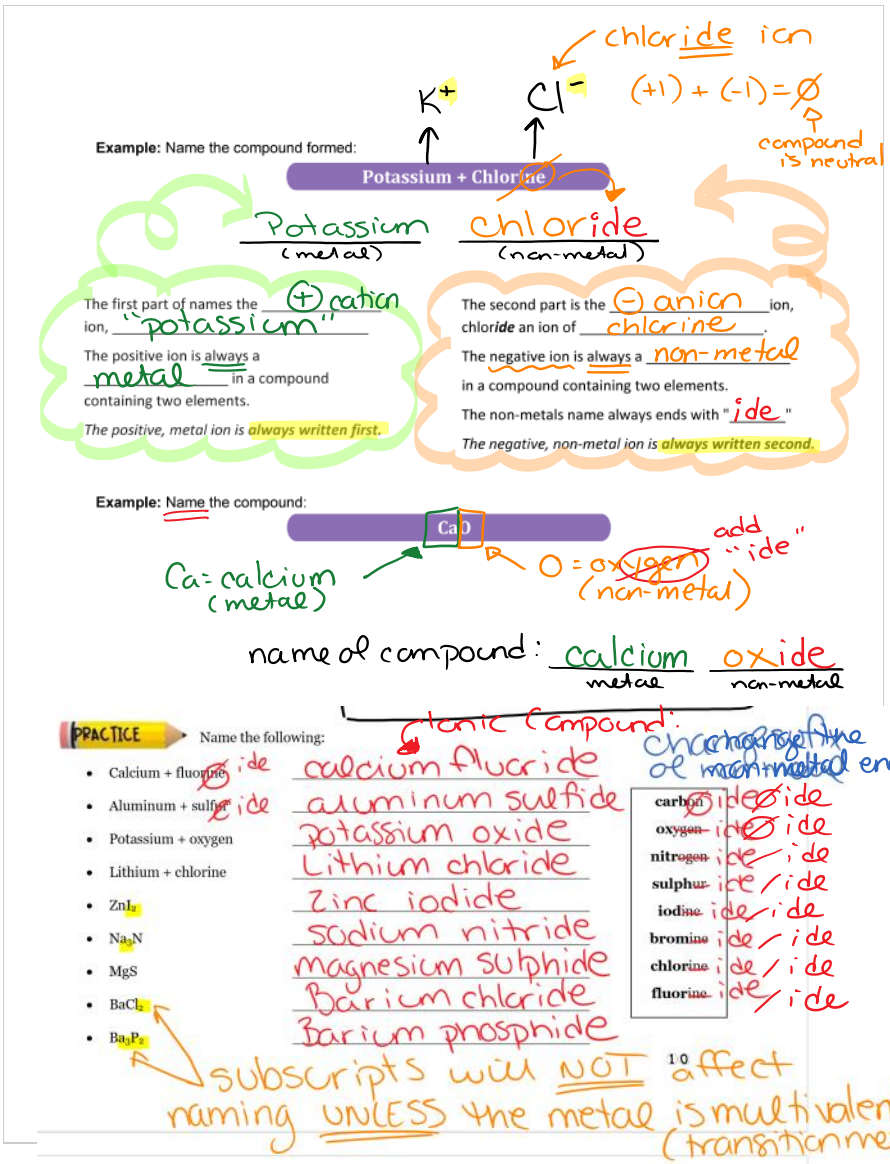
chloride ion
K^+ Cl^- (+1) + (-1) = Ø
compound is neutral
Example: Name the compound formed:
Potassium + Chloride
Potassium (metal) chloride (non-metal)
The first part of names the (+) cation ion, "potassium"
The positive ion is always a metal in a compound containing two elements.
The positive, metal ion is always written first.
The second part is the (-) anion ion, chloride an ion of chlorine.
The negative ion is always a non-metal in a compound containing two elements.
The non-metals name always ends with "ide"
The negative, non-metal ion is always written second.
Example: Name the compound:
CaO
add "ide"
Ca: calcium (metal)
O = oxygen (non-metal)
name of compound: calcium (metal) oxide (non-metal)
ionic compound:
PRACTICE
Name the following:
Calcium + fluoride — calcium fluoride
Aluminum + sulfur — aluminum sulfide
Potassium + oxygen — potassium oxide
Lithium + chlorine — Lithium chloride
ZnI_2 — zinc iodide
Na_3N — sodium nitride
MgS — magnesium sulphide
$BaCl_2$ — Barium chloride
Ba_3P_2 — Barium phosphide
change the ending of non-metal
carbon ide ide
oxygen ide ide
nitrogen ide ide
sulphur ide ide
iodine ide ide
bromine ide ide
chlorine ide ide
fluorine ide ide
subscripts will NOT affect naming UNLESS the metal is multivalent. (transition metals)

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Homework

ASSIGNMENT #2: Ionic Compounds Naming

This assignment is to be completed below in the space provided.

Name the following ionic compounds.

1. Potassium + iodine — Potassium iodide
2. Sodium + oxygen — Sodium oxide
3. Potassium + bromine — Potassium bromide
4. Zinc + sulfur — Zinc sulfide
5. Silver + oxygen — Silver oxide
6. Aluminum + iodine — Aluminium iodide
7. Lithium + bromine — Lithium bromide
8. Potassium + sulfur — Potassium sulfide
9. BaF_2 — Barium fluoride
10. Al_2O_3 — Aluminium oxide
11. NaF — Sodium fluoride
12. MgF_2 — Magnesium fluoride
13. BeS — Beryllium sulfide
14. K_2O — Potassium oxide
15. MgI_2 — Magnesium iodide

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* no using "prefix code" di, tri, tetra, etc*

2. FROM COMPOUND NAME --> CHEMICAL FORMULA

Formula Writing - Ionic Compounds

What is a chemical formula? Tells us what atoms make up the compound, and how many of each.

1 magnesium ion → $MgCl_2$ ← 2 chloride ions

Balance charge: $(+2)+(-1)+(-1)=\emptyset$ magnesium chloride

Charge Balancing Method of Formula Writing

EXAMPLE: Aluminum chloride

Step 1: Look up ion symbols + charges

Al^{3+} Cl^{-1}

Step 2: Balance the charges

MUST $= \emptyset$

atom ratio: 1 Al : 3 Cl

Al^{3+} Cl^{-1} Cl^{-1} Cl^{-1}

$(+3)+(-1)+(-1)+(-1)=\emptyset$

Chemical Formula

don't have to write 1

Al_1Cl_3

$\Rightarrow AlCl_3$

PRACTICE Sodium sulfide

Step 1: ion symbols + charges

Na^{+} S^{2-}

Step 2: Balance charges.

atom ratio: 2 Na : 1 S

Na^{+} Na^{+} S^{2-}

$(+1)+(+1)+(-2)=\emptyset$

chemical formula

Na_2S_1

$\Rightarrow Na_2S$

Swap & Drop *(criss cross)* Method of Formula Writing

EXAMPLE: Aluminum oxide

Step 1: ion symbols + charges — Al^{3+} O^{2-} — "swap" charges to create atom ratio

atom ratio = 2 : 3

Step 2: swap + drop. — Al_2O_3 — "drop" ratio numbers into the chemical formula

CHECK: $(+3)+(+3)+(-2)+(-2)+(-2) = 0$

$(+6)+(-6)$

PRACTICE Calcium nitride

Step 1: symbols + charges — Ca^{2+} N^{3-} — "swap"

atom ratio = 3 : 2 — "drop"

Step 2: swap + drop. — Ca_3N_2

CHECK charges: $(+2)+(+2)+(+2)+(-3)+(-3) = 0$

$(+6)$ (-6)

Things to watch out for with the criss cross method:

Example: Calcium oxide

Ca^{2+} O^{2-} — atom ratio: 2 : 2 → 2 ÷ 2 = 1 : 1 ⇒ CaO Ca_2O_2

*MUST SIMPLIFY

when subscripts are same # must simplify

Fraction ratios are ALWAYS simplified

$\frac{4}{8} \div 2 = \frac{2}{4} \div 2 = \frac{1}{2}$

$4:8 \div 2 = 2:4 \div 2 = 1:2$

Mn^{+4} O^{2-}

$2:4 \div 2 = 1:2$

Mn_2O_4 ✗ MnO_2 ✓

PRACTICE

1. Write the formulas of the ionic compounds containing the following ions:
   a. Na^+ and Br^- — $NaBr$
   b. K^+ and S^{2-} — K_2S
   c. Zn^{2+} and I^- — ZnI_2
   d. Mg^{2+} and N^{3-} — Mg_3N_2

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Homework

ASSIGNMENT #3: Ionic Compounds Naming & Formula Review pg 12-13
This assignment is to be completed below in the space provided.

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Combine the following:	Ions are:	Chemical Formula is:	Chemical Name is:	Total number of atoms is:
Calcium + chlorine	**Ca^{2+} Cl^-**	**$CaCl_2$**	**calcium chloride**	**1 Ca + 2 Cl = 3**
Hydrogen + iodine	H^+ I^-	HI	hydrogen iodide	1 H + 1 I = 2
Magnesium + sulfur	Mg^{2+} S^{2-}	MgS	magnesium sulfide	1 Mg + 1 S = 2
Aluminum + oxygen	Al^{3+} O^{2-}	Al_2O_3	aluminium oxide	2 Al + 3 O = 5
Lithium + fluorine	Li^+ F^-	LiF	Lithium Flucride	1 Li + 1 F = 2
Sodium + bromine	Na^+ Br^-	$NaBr$	sodium bromide	1 Na + 1 Br = 2
Barium + nitrogen	Ba^{2+} N^{3-}	Ba_3N_2	Barium nitride	3 Ba + 2 N = 5
Beryllium + chlorine	Be^{2+} Cl^-	$BeCl_2$	Beryllium chloride	1 Be + 2 Cl = 3
Zinc + oxygen	Zn^{2+} O^{2-}	ZnO	zinc oxide	1 Zn + 1 O = 2
Magnesium + iodine	Mg^{2+} I^-	MgI_2	magnesium iodide	1 Mg + 2 I = 3

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Homework Review of Naming & Formulae

Compound	Name of Ionic Compound OR Ionic Formula
1. CaI_2	Calcium iodide
2. Na_3P	Sodium phosphide
3. Ag_2O	Silver oxide
4. RbF	Rubidium fluoride
5. $MgBr_2$	Magnesium bromide
6. AgI	silver iodide
7. $AlBr_3$	Aluminium bromide
8. zinc oxide	ZO
9. barium iodide	BaI_2
10. sodium sulfide	Na_2S
11. zirconium fluoride	ZrF_4
12. zinc phosphide	Zn_3P_2
13. gallium iodide	GaI_3
14. silver nitride	Ag_3N
15. rubidium selenide	Rb_2S

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