# **Ionic compounds**

In *ionic compounds*, the constituent atoms are joined together by *ionic bonds* 

- -- an *ionic bond* is formed by the attraction between two oppositely charged ions
- Ionic bonds are formed whenever electrons are completely <u>transferred</u> from one atom to another
- Metals (which have relatively weak attraction for their valence electrons) tend to form ionic bonds when they combine with non-metals
- The attraction between ions is very strong, which results in high melting points for ionic compounds (often > 300°C)

# Formulas of ionic compounds

The **formula** of an ionic compound shows the number and types of ions that make up the compound

- · element symbols indicate the type of ions in the compound
- · subscripts indicate the number of each ion in the compound
- the <u>overall</u> charge from the positive and negative ions in the compound must be equal to <u>zero</u>



# Formulas of ionic compounds

The **formula** of an ionic compound shows the number and types of ions that make up the compound

- · element symbols indicate the type of ions in the compound
- · subscripts indicate the number of each ion in the compound
- the <u>overall</u> charge from the positive and negative ions in the compound must be equal to <u>zero</u>



# Rules for writing formulas of ionic compounds

- 1. Identify the types and numbers of ions that make up the compound
  - the overall charge from the positive and negative ions in the compound must be equal to zero
- 2. List the cation first, then the anion
- 3. Do not write the charges for the ions in the formula
- 4. Use parentheses around polyatomic ion groups if a subscript is necessary

*Example:* Magnesium chloride

Cation: Magnesium ion (Mg<sup>2+</sup>)

Anion: Chloride ion (Cl<sup>-</sup>)

CHARGE BALANCE One Mg<sup>2+</sup> ion:  $1 \times (+2) = +2$ Two Cl<sup>-</sup> ions:  $2 \times (-1) = -2$ 

Formula: MgCl<sub>2</sub>

[ <u>not</u> Cl<sub>2</sub>Mg or Mg<sup>2+</sup>Cl<sub>2</sub> ]



Naming binary ionic compounds (metal + non-metal) b. Compound contains metal that forms more than one type of cation		Naming review	
Step 1 Identify the cation (metal) and anion (nonmetal) Step 2	Example: CI- Cu <sup>2+</sup> CI-	CaO	
Determine the charge of the cation		CoCl <sub>3</sub>	
Step 3 Name the cation from its element name, followed by a Roman numeral in parentheses indicating its charge	Formula: CuCl <sub>2</sub> Metal: copper Non-metal: chlorine	ZnCl <sub>2</sub>	
<b>Step 4</b> Name the anion from its element name plus the ending <i>-ide</i>	Cation charge: +2 (Cu <sup>+2</sup> ) Cation name: copper(II) Anion name: chlor <u>ide</u>	SnO <sub>2</sub>	
<b>Step 5</b> Write the name of the cation first and the name of the anion second	Compound name: copper(II) chloride		
	9	10	
Naming ionic compound	ts containing polyatomic ions	Naming review	
a motar i polyatomio amon			
1. Based on the compound the compound	formula, identify the ions that make up	KMnO <sub>4</sub>	
<ol> <li>Based on the compound the compound</li> <li>for metals that can form include Roman numerative</li> </ol>	formula, identify the ions that make up n more than one type of positive ion, Il in parentheses indicating charge	KMnO <sub>4</sub> Al <sub>2</sub> (CrO <sub>4</sub> ) <sub>3</sub>	
<ol> <li>Based on the compound the compound</li> <li>for metals that can form include Roman numeration metals transition metals transition metals Pb and Sn</li> </ol>	formula, identify the ions that make up n more than one type of positive ion, Il in parentheses indicating charge tals (exceptions: Zn, Ag, Cd)	KMnO <sub>4</sub> Al <sub>2</sub> (CrO <sub>4</sub> ) <sub>3</sub> CuCO <sub>3</sub>	
<ol> <li>Based on the compound the compound</li> <li>for metals that can form include Roman numeration metals that can form and the cation first</li> <li>Name the cation first</li> <li>Follow with the name of the cation first</li> </ol>	formula, identify the ions that make up n more than one type of positive ion, I in parentheses indicating charge tals (exceptions: Zn, Ag, Cd) ne <u>anion</u>	KMnO <sub>4</sub> Al <sub>2</sub> (CrO <sub>4</sub> ) <sub>3</sub> CuCO <sub>3</sub> (NH <sub>4</sub> ) <sub>3</sub> PO <sub>4</sub>	
<ol> <li>Based on the compound the compound</li> <li>for metals that can forminclude Roman numera         <ul> <li>most transition me</li> <li>Pb and Sn</li> </ul> </li> <li>Name the <u>cation</u> first</li> <li>Follow with the name of the Cation</li> </ol>	formula, identify the ions that make up n more than one type of positive ion, al in parentheses indicating charge tals (exceptions: Zn, Ag, Cd) ne <u>anion</u> <u>Anion</u>	KMnO <sub>4</sub> Al <sub>2</sub> (CrO <sub>4</sub> ) <sub>3</sub> CuCO <sub>3</sub> (NH <sub>4</sub> ) <sub>3</sub> PO <sub>4</sub> Ba(NO <sub>2</sub> ) <sub>2</sub>	
<ol> <li>Based on the compound the compound</li> <li>for metals that can forminclude Roman numeration for the cation first distribution for the cation forminclude Roman numeration for the cation for the catio</li></ol>	formula, identify the ions that make up n more than one type of positive ion, il in parentheses indicating charge tals (exceptions: Zn, Ag, Cd) ne <u>anion</u> <u>Anion</u> <u>Compound name</u> SO <sub>4</sub> <sup>2-</sup> [sulfate] <u>copper(II) sulfate</u>	KMnO <sub>4</sub> $Al_2(CrO_4)_3$ $CuCO_3$ $(NH_4)_3PO_4$ $Ba(NO_2)_2$ $Cu_2SO_4$	
<ol> <li>Based on the compound the compound</li> <li>for metals that can forminclude Roman numeration metals that can forminclude Roman numeration metals transition metals transition metals transition metals and the cation first</li> <li>Name the cation first</li> <li>Follow with the name of the cation CuSO<sub>4</sub> Cu<sup>2+</sup> [copper(II)]</li> <li>Na<sub>2</sub>SO<sub>3</sub> Na<sup>+</sup> [sodium]</li> </ol>	formula, identify the ions that make up n more than one type of positive ion, al in parentheses indicating charge stals (exceptions: Zn, Ag, Cd) the <u>anion</u> <u>Anion</u> <u>Compound name</u> $SO_4^{2-}$ [sulfate] $SO_3^{2-}$ [sulfite] sodium sulfite	KMnO <sub>4</sub> $Al_2(CrO_4)_3$ $CuCO_3$ $(NH_4)_3PO_4$ $Ba(NO_2)_2$ $Cu_2SO_4$	

### Naming binary molecular compounds

**binary compound** -- a chemical compound that contains only two different elements

**binary molecular compound** -- a chemical compound that contains two different <u>non-metal</u> elements

#### Rules for naming a binary molecular compound from its formula

- 1. The element with the lower group number is named first. If the elements are in the same group, the element with the higher period number is named first.
  - -- exceptions exist for binary compounds containing hydrogen
- 2. List the full name of the first element, followed by the name of the second element with its ending changed to *-ide*
- 3. Add prefixes to indicate the numbers of atoms of each element (Note: the prefix *mono-* is never used for the first element)
- 4. If the name of the second element begins with a vowel <u>and</u> its prefix ends in -a or -o, the last letter of the prefix is often dropped for easier pronunciation

# Naming binary molecular compounds

13

- <u>Rule</u>: The compound name is made up of the name of the first element followed by the name of the second element with the *-ide* ending
  - -- add *prefixes* to indicate the number of atoms of each element (Note: the prefix *mono* is never used for the first element)



### Naming binary molecular compounds

- <u>Rule</u>: The compound name is made up of the name of the first element followed by the name of the second element with the *-ide* ending
  - -- add *prefixes* to indicate the number of atoms of each element (Note: the prefix *mono*- is never used for the first element)

#### Prefixes:

<i>mono</i> = 1	tetra = 4	hepta = 7	<i>nona</i> = 9
<i>di</i> = 2	penta = 5	octa = 8	<i>deca</i> = 10
tri - 3	heva - 6		

### Naming binary molecular compounds

14

- <u>Rule</u>: The compound name is made up of the name of the first element followed by the name of the second element with the *-ide* ending
  - -- add *prefixes* to indicate the number of atoms of each element (Note: the prefix *mono-* is never used for the first element)



16

# Naming binary molecular compounds

<u>Rule</u>: The compound name is made up of the name of the first element followed by the name of the second element with the *-ide* ending

-- add *prefixes* to indicate the number of atoms of each element (Note: the prefix *mono-* is never used for the first element)



# Naming review

<text>

# Examples of binary molecular compound names

C	CI4	carbon tetrachloride	
S <sub>2</sub>	F <sub>10</sub>	disulfur decafluoride	
N	С	nitrogen monoxide(commonly called nitric oxide)	
Na	20	dinitrogen monoxide (commonly called nitrous oxide)	
SC	<b>D</b> 3	sulfur trioxide (don't confuse with sulfite ion: $SO_3^{2-}$ )	
<u>Note</u> : Compounds between phosphorus and oxygen are often named as though phosphorous was a metal			
P <sub>4</sub> O <sub>6</sub>	tetrap <u>or</u> př	phosphorus hexoxide (common name: <u>phosphorus trioxide</u> ) hosphorus(III) oxide	
P <sub>4</sub> O <sub>10</sub>	tetraph <u>or</u> pho	nosphorus decoxide (common name: <u>phosphorus pentoxide</u> ) sphorus(V) oxide	
		18	