

4.5 Predict ratios forming ionic compounds and use chemical formulas

Review of Terms!

1. **Cation**: positively charged ion
 - Non metal or metal?
2. **Anion**: negatively charged ion
 - Non metal or metal?

Chemical Formula Terms

1. **Symbol**: notes the element being used
2. **Subscript**: shows how many of the individual atoms are present

ex. O_2
 CO_2
 HBr

3. **Binary Compounds**: composed of 2 elements

Chemical Formula Terms

4. **Oxidation Number**: same as “charge”, how many electrons atoms need to gain or lose (to become stable)

****get off of periodic table!!**

****write them on your P.T. (Al = +3)**

5. **Coefficient Number**: placed *before* the element or compound, distributed to entire compound

ex. 2HBr



Chemical Formulas

The chemical symbols and numbers indicating the number of atoms contained in the basic unit of a substance



Carbon = 6 atoms

Hydrogen = 12 atoms

Oxygen = 6 atoms

How many atoms of each element are present in 3 molecules of glucose?



C=18

H=36

O=18

- 1. How many oxygen atoms are there in bleach, also known as sodium hypochlorite (NaClO)?**
- 2. Acetone (CH_3COCH_3) or nail polish remover has how many total hydrogen atoms?**
- 3. How do you determine oxidation numbers?**
- 4. What is the oxidation number of Al, O, and Cl?**

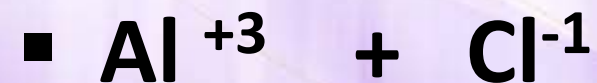
Writing Ionic Formulas

- The elements overall charges have to equal zero
 - Compounds have no net charge!!
- Write the cation first with its charge, then the anion and its charge.
 - $\text{Al}^{+3} \quad \text{F}^{-1}$
- Write the chemical formula, using subscripts to indicate how many of each ion are needed to make a neutral compound.
 - use the criss-cross method: $\text{Al}^{+3} \quad \text{F}^{-1} = \text{AlF}_3$

MORE COMPOUNDS!!

- Balance the formula so the compound formed has a neutral charge

Examples:



Learning Check

Indicate whether a bond between the following would be **1) ionic** **2) covalent**

- _____ A. sodium and oxygen
- _____ B. nitrogen and oxygen
- _____ C. phosphorus and chlorine
- _____ D. calcium and sulfur
- _____ E. chlorine and bromine

Solution

Indicate whether a bond between the following would be **1) ionic** **2) covalent**

- 1** A. sodium and oxygen
- 2** B. nitrogen and oxygen
- 2** C. phosphorus and chlorine
- 1** D. calcium and sulfur
- 2** E. chlorine and bromine

Ionic Compounds

- Attraction between _____ ions and _____ ions
- Metals _____ electrons and form _____ ions.
- Nonmetals _____ electrons and form _____ ions.

Valence Electrons

What are valence electrons?

What is the importance of valence electrons?

How can you determine the number of valence electrons?

Lewis (Electron-Dot) Structures

What does the octet rule state?

Write the electron-dot structures for:

1. Sr
2. Fe
3. Bi
4. Br

Learning Check

Write the correct formula for the compounds containing the following ions:

A. Na^+ , S^{2-}

B. Al^{3+} , Cl^-

C. Mg^{2+} , N^{3-}

Solution

A. Na^+ , S^{2-}

2) Na_2S

B. Al^{3+} , Cl^-

1) AlCl_3

C. Mg^{2+} , N^{3-}

3) Mg_3N_2

Naming Binary Ionic Compounds

- Contain 2 different elements
- Name the metal first, then the nonmetal, modifying the suffix to -ide.
- Use name of a metal with a fixed charge

Groups 1, 2, 13 and Ag (+1), Zn (+2), and Cd (+2)

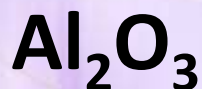
Examples:



sodium chloride



zinc iodide



aluminum oxide

Learning Check

Complete the names of the following binary compounds:









Solution

Complete the names of the following binary compounds:



sodium **nitride**



potassium **bromide**



aluminum **oxide**



magnesium **sulfide**

Transition Metals

Many form 2 or more positive ions, ALWAYS give oxidation number in parenthesis after symbol

<u>1+</u>	<u>2+</u>	<u>1+ or 2+</u>	<u>2+ or 3+</u>
Ag^+	Cd^{2+}	$\text{Cu}^+, \text{Cu}^{2+}$	$\text{Fe}^{2+}, \text{Fe}^{3+}$
silver ion	cadmium ion	copper(I) ion copper (II) ion	iron(II) ion iron(III) ion
	Zn^{2+} zinc ion		

Learning Check

- A. The formula for the ionic compound of Na^+ and O^{2-} is
- B. The formula of a compound of aluminum and chlorine is
- C. The formula of Fe^{3+} and O^{2-} is

Solution

A. The formula for the ionic compound of Na^+ and O^{2-} is



B. The formula of a compound of aluminum and chlorine is



C. The formula of Fe^{3+} and O^{2-} is



Names of Variable Ions

Use a roman number after the name of a metal that forms two or more ions

Transition metals and the metals in groups 4A and 5A



(Fe³⁺) iron (III) chloride



(Cu⁺) copper (I) chloride



(Sn⁴⁺) tin (IV) fluoride



(Pb²⁺) lead (II) chloride



(Fe³⁺) iron (III) sulfide

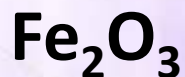
Learning Check

Complete the names of the following binary compounds with variable metal ions:











Solution

Complete the names of the following binary compounds with variable metal ions:

FeBr_2 iron (II) bromide

Cu_2O copper (I) oxide

SnCl_4 tin (IV) chloride

Fe_2O_3 iron (III) oxide

CuS copper (II) sulfide

Learning Check

Name the following compounds:

A. CaO

1) calcium oxide

2) calcium(I) oxide

3) calcium (II) oxide

B. SnCl_4

1) tin tetrachloride

2) tin(II) chloride

3) tin(IV) chloride

C. Co_2O_3

1) cobalt oxide

2) cobalt (III) oxide

3) cobalt trioxide

Solution

Name the following compounds:

A. CaO

1) calcium oxide

B. SnCl_4

2) tin(IV) chloride

C. Co_2O_3

3) cobalt (III) oxide