Small-Scale Experiment

6 Chemical Names and Formulas

Text Sections 5.10 and 5.11

Objectives

- **Write** the chemical names and formulas of common chemical compounds.
- **Describe** the colors and textures of common ionic compounds.
- **Synthesize** chemical compounds, and write their names and formulas.

Introduction

Chemical substances are described not only by unique names but also by chemical formulas. A chemical name will describe a unique chemical formula and a chemical formula will have a unique chemical name. We use this language to communicate about chemistry.

All ions, of which some substances are made, have unique chemical names. The names and formulas of common monatomic and polyatomic anions and cations are listed below.

Name	Formula	Name	Formula
fluoride	F^-	oxide	O^{2-}
chloride	Cl^-	sulfide	S^{2-}
bromide	Br^-	sulfate	SO_4^{2-}
iodide	I^-	carbonate	CO_3^{2-}
acetate	CH_3COO^-	hydrogen phosphate	HPO_4^{2-}
nitrate	NO_3^-	phosphate	PO_4^{3-}
nitrite	NO_2^-		
hydroxide	OH^-		
hydrogen carbonate	HCO_3^-		
dihydrogen phosphate	$H_2PO_4^-$		
sodium	Na^+	magnesium	Mg^{2+}
potassium	K^+	calcium	Ca^{2+}
copper(I)	Cu^+	copper(II)	Cu^{2+}
ammonium	NH_4^+	iron(II)	Fe^{2+}
		iron(III)	Fe^{3+}
		lead(II)	Pb^{2+}
		lead(IV)	Pb^{4+}
		tin(II)	Sn^{2+}
		tin(IV)	Sn^{4+}

Most transition metals and the representative elements tin and lead form two or more cations. To distinguish different cations of the same element, a Roman numeral is used in the name to indicate the numerical value of the charge.

Cations and anions combine in a ratio that makes all ionic compounds electrically neutral. Formulas for ionic compounds are written so that the positive charge contributed by the cations exactly balances the negative charge contributed by the anions. For example, the formula for the ionic compound formed from Na^+ cations and O^{2-} anions is Na_2O. The formula for the cation is always written first. The subscript, 2, refers to two Na^+ ions that exactly balance the 2^- charge on one O^{2-} ion. To name an ionic compound, state the name of the cation and the name of the anion. Don't forget to use a Roman numeral to specify the numerical value of the positive charge of those atoms that form more than one cation. Some examples of formulas and names of ionic compounds are listed below.

Na_2O	sodium oxide	$CaSO_4$	calcium sulfate
KF	potassium fluoride	NH_4Br	ammonium bromide
FeS	iron(II) sulfide	$Cu_3(PO_4)_2$	copper(II) phosphate
$FeCl_3$	iron(III) chloride	$Pb(OH)_2$	lead(II) hydroxide

Purpose

In this lab you will observe and describe the colors and textures of various ionic compounds. Either the names or formulas of these compounds will be given. If the name is given, you will write its formula, and if the formula is given, you will write its name.

Safety

- Wear your safety glasses.
- Use full small-scale pipets only for the carefully controlled delivery of liquids.

Equipment

empty pipet for stirring
small-scale reaction surface with dried solid ionic compounds

Name _____ Class _____ Date _____

Experimental Page

1. Observe the solid compounds below. Write the color and any other descriptive information. If the name is given, write the formula. If the formula is given, write the name. Record your results in Table 6.1.

	potassium dichromate	sodium chloride	magnesium sulfate	copper(II) sulfate
mula				
scrip tion				

	$NaHCO_3$	$AgNO_3$	$NaNO_2$	KF
me				
scrip tion				

	sodium carbonate	lead(II) nitrate	sodium acetate	ammonium chloride
mula				
scrip tion				

	sodium phosphate	calcium hydroxide	tin(IV) chloride	potassium bromide
mula				
scrip tion				

	$CaCl_2$	$FeCl_3$	$MnCl_2$	$Cu(C_2H_3O_2)_2$
ame				
scrip tion				

Name _____ Class _____ Date _____

Now It's Your Turn!

1. a. Place 1 drop of each solution in the indicated spaces below. Stir by blowing air from a dry pipet.

b. Combine the ions to write the formulas of the chemical compounds that are produced by the mixings. Name each compound.

c. What happened with each mixing? Make a table describing your results. Write the formula and name of each compound produced by the mixings.

	$AgNO_3$ Ag^+	$Pb(NO_3)_2$ Pb^{2+}	$CuSO_4$ Cu^{2+}	$MgSO_4$ Mg^{2+}	$FeCl_3$ Fe^{3+}
$FeCl_3$ (Cl^-)					
KI (I^-)					
NaOH (OH^-)					
Na_2CO_3 (CO_3^{2-})					
Na_3PO_4 (PO_4^{3-})					

Name _____ Class _____ Date _____

Questions for Analysis

Use what you learned in this lab to answer the following questions.

1. Write the formulas (with charges) and names of all the cations represented in this experiment.

2. Write the formulas (with charges) and names of all the anions represented in this experiment.

3. Write some simple rules for naming an ionic compound.

4. When is it appropriate to use Roman numerals in naming compounds?

5. What does a numerical subscript following an element in a chemical formula mean?

6. What does a numerical subscript following a set of parentheses in a chemical formula mean?

7. Write some simple rules for writing the formula for an ionic compound.