

Unit 07:

Naming Compounds

Driving Questions

- ❖ What are ions?
- ❖ What are the different rules for naming compounds?

Connections to Past/Future Units

- ❖ Understand how the difference between ionic and molecular compounds
- ❖ Use the naming rules with chemical compounds and chemical reactions

Objectives: *SWBAT*...

- Understand the difference between ionic and molecular
- Apply naming rules to groups A, B, nonmetal, and acid compounds to determine the name.
- Be able to determine the chemical formula from the name, using the naming rules.

Essential Vocabulary

A Group

B Group

Nonmetals

Metals

Ions

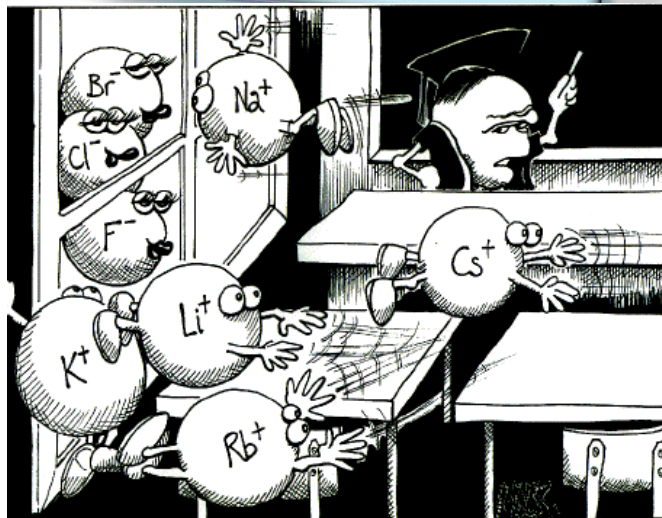
Cations

Anions

Name: _____ Period: _____

Packet Grade: _____/150pts

- ❖ Objective; Implications; reflection /10pts
- ❖ Reading Charts: 30pts
- ❖ Worksheets: 10pts per page
- ❖ Stamps: 2pts/stamp



"Perhaps one of you gentlemen would mind telling me just what it is outside the window that you find so attractive...?"

Personal Objective: Looking at the objectives above, what more do you want to learn this unit?

Implications of unit: Why are we studying this unit? Where does it fit in chemistry? Why is it necessary?

Reflection: Did you accomplish your personal objective? What further questions do you have about this unit?

SWBAT identify cations and anions based on their location on the periodic table.

Acids
Polyatomic ions

Unit 07 – Chemical Names and Formulas

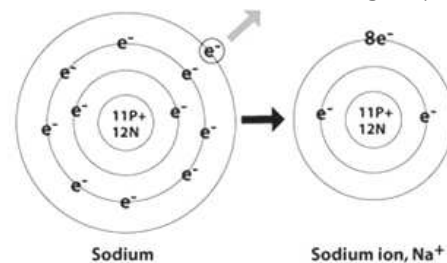
Discussion Sheet 7b – Cations and Anions

NAME: _____

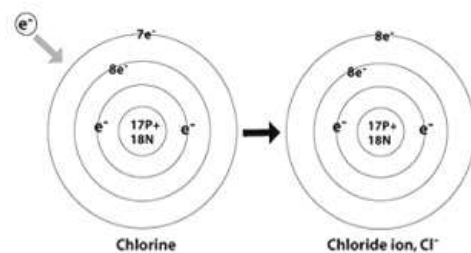
In nature, only the noble gas elements, such as helium and neon, tend to exist as isolated atoms. They are **monatomic**; that is, they consist of single atoms. Many elements found in nature are in the form of molecules. A **molecule** is the smallest electrically neutral unit of a substance that still has the properties of the substance. Molecules are made up of two or more atoms that act as a unit. For example, the oxygen gas in the air you breathe consists of oxygen molecules that contain two oxygen atoms each. Oxygen is an example of a **diatomic** molecule. Compounds composed of molecules are called **molecular compounds**.

Not all compounds are molecular. Many compounds are composed of particles called ions. **Ions** are atoms or groups of atoms that have a positive or negative charge. An ion forms when an atom or group of atoms loses or gains electrons.

Atoms of the metallic elements, such as sodium, tend to form ions by losing one or more electrons. Such ions are called **cations**, and have positive charges. Look at the diagram on the right. The sodium atom has 11 protons and 11 electrons. The sodium ion has 11 protons, but only 10 electrons. Therefore, the cation must have a charge of 1+. The symbol for an ion is written by first providing the chemical symbol, followed by writing the charge out as a superscript. The symbol for a sodium cation would therefore be Na^{1+} .



Atoms of nonmetallic elements tend to form ions by gaining one or more electrons. In this way they form **anions**, which are atoms or groups of atoms that have a negative charge. An anion has more electrons than the electrically neutral atom from which it formed. A chlorine atom has 17 protons and 17 electrons. When it gains one electron, it gets an ionic charge of 1-. The symbol of this anion would therefore be Cl^{1-} .



The name of an anion is not the same as the element name. To name an anion, you must change the ending of the name to "-ide." Therefore, the name of the Cl^{1-} ion would be chloride. When oxygen gains two electrons, it becomes oxide. When phosphorus gains three electrons, it becomes phosphide.

Ionic compounds are composed entirely of metal cations and nonmetal anions. The positively charged cation is attracted to the negatively charged anion. This attraction results in the formation of an **ionic bond**, a very strong force that holds these ions together.

An older, less preferred method of naming these cations is the **Classical system**. The Classical system uses a root word for the element with different suffixes at the end of the word. The classical name for the element is used to form the root word. In naming an ion of iron, the root word "ferr-" would be used. This word, *ferr-*, is derived from *ferrum*, the Latin word meaning iron. The suffix *-ous* is used to name the cation with the lower of two ionic charges. The suffix *-ic* is used to name the cation with the greater ionic charge. Therefore, the Fe^{2+} cation would be named "ferrous," while the Fe^{3+} cation would be called "ferric."

The Stock system is more commonly used for naming than the Classical system for a good reason. To use the Stock system, you only need to know the name of the element and the Roman numeral for the charge. In order to properly use the Classical system, you must know the Latin root word for all of the metals involved, as well as the charge.

Some transition metals only form one ionic charge. The names of these cations do not ever have a Roman numeral. These exceptions include silver, with cations that always have a 1+ charge (Ag^{1+}), and cadmium and zinc, with cations that always have a 2+ charge (Cd^{2+} and Zn^{2+}).

Common Polyatomic Ions

Unit 7, Menezes, p.5

Cations		Anions	
1+	1-	2-	3-
Name Formula	Name Formula	Name Formula	Name Formula
Ammonium ion NH_4^+	Bicarbonate ion HCO_3^-	Carbonate ion CO_3^{2-}	Phosphite ion PO_3^{3-}
Hydronium ion H_3O^+	Cyanide ion CN^-	Chromate ion CrO_4^{2-}	Phosphate ion PO_4^{3-}
	Hydrogen Sulfate ion HSO_4^-	Dichromate ion $\text{Cr}_2\text{O}_7^{2-}$	
	Hydrogen Sulfite ion HSO_3^-	Oxalate ion $\text{C}_2\text{O}_4^{2-}$	
	Hydroxide ion OH^-	Silicate ion SiO_3^{2-}	
	Perchlorate ion ClO_4^-	Hydrogen Phosphate ion HPO_4^{2-}	
	Chlorate ion ClO_3^-	Sulfate ion SO_4^{2-}	
	Chlorite ion ClO_2^-	Sulfite ion SO_3^{2-}	
	Hypochlorite ion ClO^-	Thiosulfate ion $\text{S}_2\text{O}_3^{2-}$	
	Nitrate ion NO_3^-		
	Nitrite ion NO_2^-		
	Acetate ion $\text{C}_2\text{H}_3\text{O}_2^-$		
	Permanganate ion MnO_4^-		

READING ASSIGNMENT: Read and take notes on pages _____ in your textbook.

SEE

THINK

Unit 07 - Chemical Names and Formulas
SWS Naming A- Group Ionic Compounds (Page 1)

NAME: _____

COMPOUND FORMULA	CATION FORMULA + NAME	ANION FORMULA + NAME	NAME: CATION + ANION
1. NaBr			
2. NH ₄ F			
3. CaCO ₃			
4. Li ₂ SO ₃			
5. Zn ₃ P ₂			
6. Sr(C ₂ H ₃ O ₂) ₂			
7. Ag ₃ PO ₄			
8. CsClO ₃			
9. KMnO ₄			
10. CaSO ₃			

Unit 07 - Chemical Names and Formulas
SWS Naming A- Group Ionic Compounds (Page 2)

NAME: _____

COMPOUND NAME	CATION FORMULA + NAME	ANION FORMULA + NAME	CRISS CROSS	SIMPLIFY
11. lithium acetate				
12. calcium bromide				
13. gallium chloride				
14. sodium hydride				
15. beryllium hydroxide				
16. zinc carbonate				
17. ammonium oxide				
18. potassium hydroxide				
19. silver cyanide				
20. strontium acetate				
21. radium sulfate				
22. ammonium sulfate				

Unit 07 - Chemical Names and Formulas

NAME: _____

Worksheet 7.01 Naming A- Group Ionic Compounds

Name the compounds on the top half of the paper, and write the symbol for the compounds on the bottom half of the page.

Ba(NO₃)₂ _____

Al(OH)₃ _____

NaCl _____

CaBr₂ _____

Fr₃AsO₄ _____

MgCO₃ _____

Ag₂CO₃ _____

Ca(BrO₃)₂ _____

KOH _____

BaSO₃ _____

Mg(OH)₂ _____

Ba(HSO₃)₂ _____

Magnesium chloride	Mg ²⁺ Cl ¹⁻	MgCl ₂
Potassium permanganate		
Silver carbonate		
Calcium acetate		
Cadmium nitrate		
Aluminum fluoride		

Unit 07 - Chemical Names and Formulas
SWS Naming B- Group Ionic Compounds

NAME: _____

COMPOUND FORMULA	CATION FORMULA + NAME	ANION FORMULA + NAME	NAME: CATION + ANION
1. NiPO_4			
2. Cu_2O			
3. SnS_2			
4. $\text{Ti}(\text{CN})_4$			
5. Pb_3N_2			
6. CoCO_3			
7. $\text{Cu}(\text{NO}_2)_2$			
8. $\text{Fe}(\text{HCO}_3)_2$			

COMPOUND NAME	CATION FORMULA + NAME	ANION FORMULA + NAME	CRISS CROSS
12. iron (II) phosphate			
13. titanium (II) selenide			
14. manganese (VII) arsenide			
15. copper (II) chlorate			
16. cobalt (III) chromate			
17. lead (IV) sulfate			
18. vanadium (V) nitride			

Unit 07 - Chemical Names and Formulas

NAME: _____

Worksheet 7.02 - Naming B- Group Ionic Compounds

Name the compounds on the top half of the paper, and write the symbol for the compounds on the bottom half of the page.

 $\text{Fe}(\text{ClO}_3)_3$ _____ AuNO_3 _____

 $\text{Pb}(\text{ClO}_2)_4$ _____ $\text{V}(\text{NO}_2)_5$ _____

 CrBr_3 _____ $\text{Ni}_3(\text{PO}_4)_2$ _____

 ScCr_2O_7 _____ PtSCN _____

 $\text{Fe}(\text{IO}_3)_2$ _____ TiCrO_4 _____

 CuCrO_4 _____ Cu_2CrO_4 _____

Name	Cation, Anion, Criss Cross	Compound (symbol)
Iron (III) dichromate		
Lead (IV) sulfite		
Lead (II) nitrate		
Iron (II) sulfide		
Iron (III) sulfide		
Chromium (III) nitrate		
Iron (III) carbonate		
Titanium (II) chloride		
Lead (IV) chloride		
Iron (II) oxide		
Iron (III) oxide		

Unit 07 - Chemical Names and Formulas

NAME: _____

SWS: Covalent

Rules for naming:

1. Write the names for the compounds as if they were ions. Example: NO_2 would be Nitrogen oxide
2. Now look at the subscripts that tell you the number of atoms. Add the appropriate pre-fix to each name. The only exception is if the first element has only one atom. DO NOT ADD MONO. Example: NO_2 would be Nitrogen **D**ioxide. There is no "mono" added to nitrogen since it is first.
3. Try N_2O .

one	mono-	six	hexa-
two	di-	seven	hepta-
three	tri-	eight	octa-
four	tetra-	nine	nona-
five	penta-	ten	deca-

Write the formula for the following

Formula	Name
	chlorine monoxide
	phosphorous trichloride
	Diphosphorous pentoxide
	carbon dioxide
	sulfur tetrachloride
	nitrogen trifluoride
	dinitrogen monoxide
	boron monophosphide
	oxygen difluoride

Write the name for the following

Formula	Name
PCl_5	
CO	
PCl_3	
XeF_4	
NI_3	
N_2O_3	
BN	
As_4O_{10}	

Unit 07 - Chemical Names and Formulas
Worksheet 7.03 - Covalent Naming Practice

NAME: _____

1. Write the names of the following molecular compounds.

 P_4O_{10} _____ BBr_3 _____ N_2O_5 _____ P_2O_5 _____ SCl_6 _____ SCl_2 _____ CCl_4 _____ As_2S_5 _____ PCl_3 _____ $SeCl_6$ _____ SI_2 _____ OF_2 _____

2. Write the formulas of the following molecular compounds.

silicon dioxide _____

dinitrogen pentasulfide _____

dinitrogen heptoxide _____

sulfur trioxide _____

triarsenic monoxide _____

iodine monochloride _____

tellurium difluoride _____

selenium dibromide _____

tetraphosphorus decasulfide _____

diphosphorus trifluoride _____

nitrogen triiodide _____

oxygen diiodide _____

READING ASSIGNMENT: Read and take notes on pages _____ in your textbook.

SEE

THINK

READING ASSIGNMENT: Read and take notes on pages _____ in your textbook.

SEE

THINK

Unit 07 - Chemical Names and Formulas

NAME: _____

SWS NAMING ACIDS*Name the following acids:*2) H_2SO_3 _____3) H_2S _____4) H_3PO_4 _____6) HCN _____9) H_3P _____*Write the formulas of the following acids:*

10) hydrofluoric acid _____

11) hydroselenic acid _____

12) carbonic acid _____

14) nitrous acid _____

16) sulfuric acid _____

18) hydrobromic acid _____

Unit 07 - Chemical Names and Formulas
Worksheet 7.04 - Acid Naming Practice

NAME: _____

1. Write the names of the following molecular compounds.

HCl _____

HBrO₃ _____HNO₃ _____H₃PO₄ _____H₂C₂O₄ _____HClO₄ _____

HSCN _____

HF _____

HCN _____

H₃N _____H₂O (Not water) _____H₂S₂O₃ _____

2. Write the formulas of the following molecular compounds.

Chromic Acid _____

Hydroiodic Acid _____

Arsenic Acid _____

Permanganic Acid _____

Carbonic Acid _____

Nitrous Acid _____

Hypochlorous Acid _____

Sulfuric Acid _____

Iodic Acid _____

Iodous Acid _____

Hydrosulfuric Acid _____

Hydrophosphoric Acid _____

Unit 07 - Chemical Names and Formulas

NAME: _____

Worksheet 7.05 - Naming Review

1. Use your textbook and notes to complete the following sentences by filling in the blanks with a term or short phrase.

a) Elements that are nonlustrous and are poor conductors of electricity are classed as _____.

b) The Group B elements are known as the _____ metals.

c) A _____ is any atom or group of atoms with a positive charge.

d) The metals in Groups 1A, 2A, and 3A _____ electrons when they form ions.

e) The one common polyatomic ion that is positively charged is the _____ ion.

f) The formula for the hydrogen carbonate ion is _____.

2. On the left, identify the following compounds as Ionic or Molecular. On the right, name the compounds:

_____ FeCrO_4 _____

_____ $(\text{NH}_4)_2\text{SO}_4$ _____

_____ N_5O_7 _____

_____ C_4Cl_2 _____

_____ $\text{Mn}(\text{C}_2\text{H}_3\text{O}_2)_3$ _____

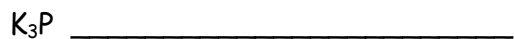
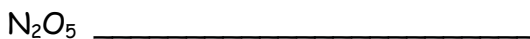
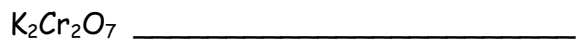
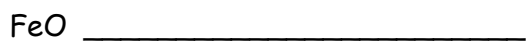
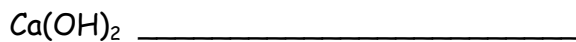
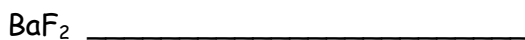
_____ Li_2CO_3 _____

_____ O_4F_9 _____

Unit 07 - Chemical Names and Formulas
Worksheet 7.05 - Final Naming Review

NAME: _____

Name the following compounds. Some of them are ionic. Some of them are molecular.



Unit 07 - Chemical Names and Formulas
Worksheet 7.06 - Final Formula Review

NAME: _____

Write formulas for these compounds. Some of them are ionic. Some of them are molecular.

trinitrogen dioxide _____

zinc bicarbonate _____

pentanitrogen heptachloride _____

cadmium phosphate _____

sulfur dibromide _____

gold (III) bisulfite _____

lead (II) chlorate _____

lead (IV) chlorite _____

pentaphosphorus monoxide _____

dichlorine tribromide _____

aluminum hydrogen carbonate _____

iron (III) acetate _____

carbon dioxide _____

titanium (II) oxalate _____

silver dichromate _____

cesium cyanide _____

tetrasulfur monoiodide _____

magnesium hypochlorite _____

pentaselenium heptoxide _____

magnesium chromate _____

lead (II) perchlorate _____

heptachlorine monofluoride _____

sodium oxide _____

oxygen dichloride _____

palladium (II) iodate _____

potassium hydroxide _____

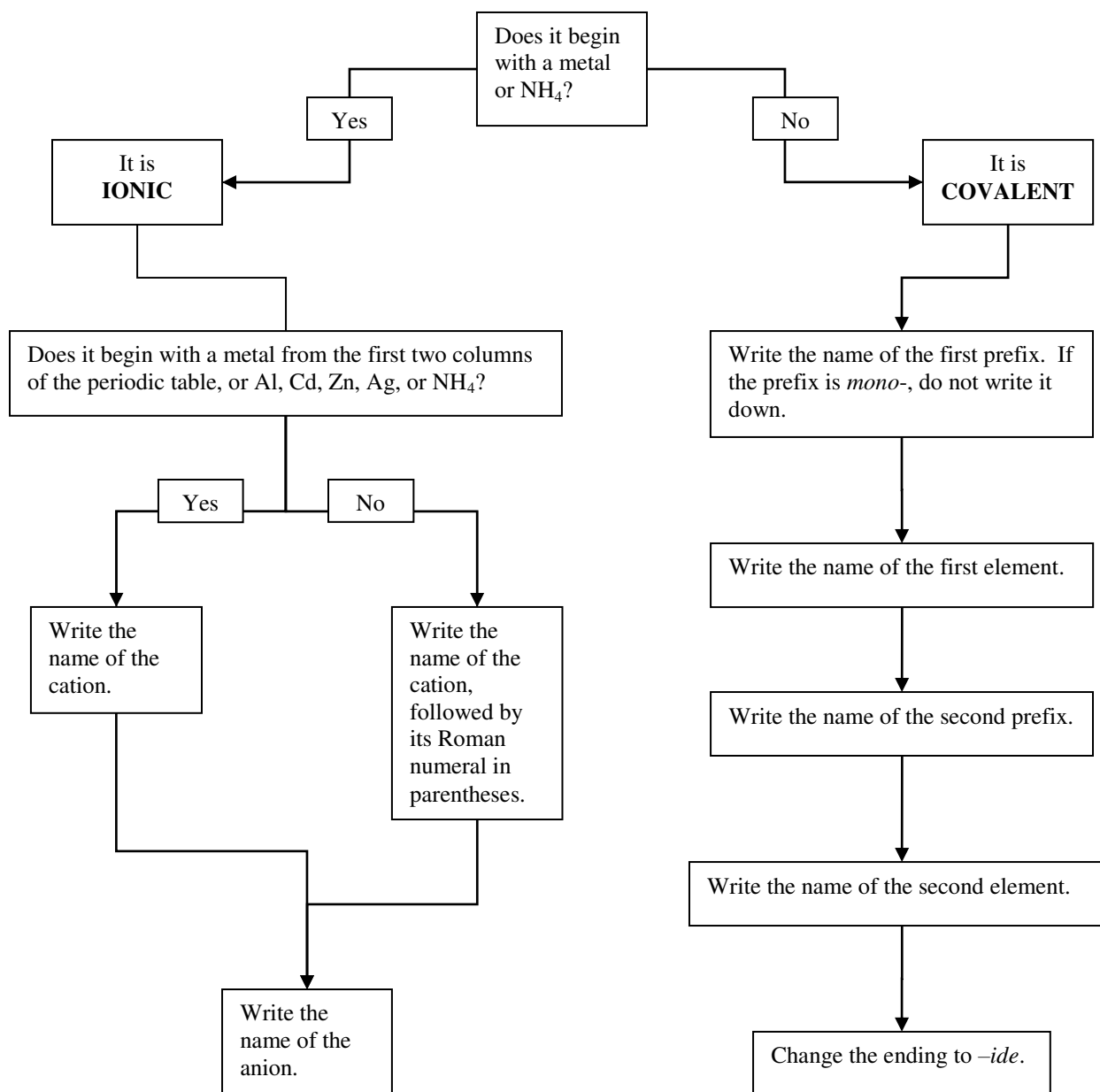
nickel (II) bromide _____

tin (IV) hydrogen carbonate _____

Unit 07 - Chemical Names and Formulas
Discussion Sheet 7d - Naming Summary Chart

NAME: _____

The following chart is designed to help you name simple compounds.



Remember that if it starts with hydrogen then it is an acid.