Important Concepts . . .

Preview Review

Science *Grade 9* *TEACHER KEY*

W2 - Lesson 4: Naming Chemical Compounds

V5-07

Important Concepts of Grade 9 Science

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W1 - Lesson 2 .....Electrical Circuits
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W3 - Lesson 5 ..... Transfer of Materials through the Air, Ground, and Water/Biological Impacts of Hazardous Chemicals
W3 - Quiz

Materials Required

Textbook:
Science in Action 9

Science Grade 9
Version 5
Preview/Review W2 - Lesson 4 TEACHER KEY

Publisher: Alberta Distance Learning Centre
Author: Nicole Bondarchuk
In-House Reviewer: Barb Philips

Project Coordinator: Dennis McCarthy
Preview/Review Publishing Coordinating Team: Nina Johnson, Laura Renkema, and Donna Silgard

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Preview/Review Concepts for Grade Nine Science

TEACHER KEY

W2 - Lesson 4:
Naming Chemical Compounds

OUTLINE

By the end of this lesson, you should

- combine chemical ratios
- write chemical formulas for compounds of two elements
- write chemical names for common chemicals
- construct word equations using chemical names and chemical formulas

GLOSSARY

chemical formula - a combination of symbols representing a compound; the formula identifies the elements in the compound and the amount of each element

ion - an atom that is electrically charged because it has lost or gained electrons; a positive ion is an atom that has lost one or more electrons; a negative ion is an atom that has gained one or more electrons

ozone ($O_{3(g)}$) - a colourless, odourless gas; at ground level, it is a pollutant resulting from industrial processes and motor vehicles; high in the atmosphere, it forms a layer protecting Earth from the Sun's ultraviolet radiation

W2 - Lesson 4: Naming Chemical Compounds

Salt is one of the most familiar chemical compounds. The chemical name for salt is sodium chloride. The chemical formula for salt is NaCl. In this lesson, you will learn how to name and write formulas for various chemical compounds.

If you look at the formula and chemical name for salt, NaCl (sodium chloride), and look at the periodic table on page 508 of your textbook, you should notice that salt has one ion of sodium and one ion of chlorine. Salt is classified as an ionic compound because it is made of a metal and a non-metal ion.

Since 1920, the International Union of Pure and Applied Chemistry (IUPAC) has been responsible for deciding on appropriate names and formulas for chemical compounds. This is to standardize all chemical names throughout the world.

Read page 141 of *Science in Action 9*.

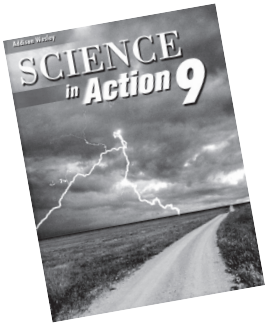
1. Identify the elements found in the following compounds.

   a. SO_2 ***sulfur, oxygen***

   b. $HgCl_2$ ***mercury, chlorine***

   c. KI ***potassium, iodine***

   d. MgF_2 ***magnesium, fluorine***



2. Given the following names and chemical formulas, identify the elements and number of atoms or ions present in each compound.

		Elements	# of Atoms or Ions	
a.	lithium bromide (LiBr)	***lithium, bromine***	***1***	***1***
b.	zinc chloride ($ZnCl_2$)	***zinc, chlorine***	***1***	***2***
c.	calcium oxide (CaO)	***calcium, oxygen***	***1***	***1***
d.	carbon dioxide (CO_2)	***carbon, oxygen***	***1***	***2***

Naming Ionic Compounds

You will remember from the previous lesson that an ionic compound is made of a metal element and a non-metal element. The **shell** of an egg is calcium carbonate, which is an ionic compound. The metal and non-metal elements form ions (lose and gain electrons) to become stable compounds. Ionic compounds are usually in a solid state at room temperature. We indicate this by putting a (s) sign as a subscript at the end of the formula.

To name ionic compounds, we write the name of the metal element first in lowercase letters. The name of the non-metallic element is written next. The only thing you have to remember is to drop the last few letters of the non-metallic element name and end the word in **ide**. For example, Na_2S is named **sodium sulfide**.

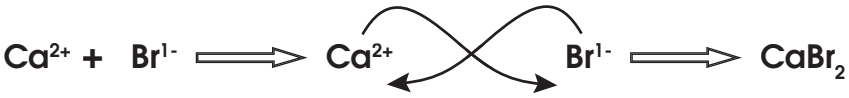
Some metallic elements can form more than one ion. To indicate which ion is used, you must put a roman numeral in brackets between the name of the metal element and the name of the non-metal element. For example Fe_2O_3 (using the Fe^{3+} ion) should be written as **iron (III) oxide**. The other possible compound that can be made using iron and oxygen is FeO which should be written as **iron (II) oxide.**

To write the chemical formula of an ionic compound, you must look at the ion charges of each element in the name of the compound. For example, calcium bromide is made of the elements calcium and bromine.

Refer to the periodic table on page 508 of your textbook.

Step 1	**List the chemical symbol for each element.**	**Ca, Br**
Step 2	**List the ion charge for each element.** (This is written as a superscript on the right side of the element symbol.)	**Ca^{2+}, Br^{1-}**
Step 3	**Balance the ion charges** (The number of + charges should equal the number of – charges.)	**Ca^{2+}, Br^{1-}, Br^{1-}**
Step 4	**Write the chemical formula.**	**$CaBr_{2\,(s)}$**

Note – An easy way to check if your formula is right is to bring down the superscript ions to become subscripts on the opposite element. The subscripts must be put into lowest form as well. Look at the following diagram.



Read pages 146-147 of *Science in Action 9*.

3. Name the following chemical compounds.

a. $FeO_{(s)}$ ***iron (II) oxide***

b. $HgCl_2$ ***mercury (II) cloride***

c. $AgCl_{(s)}$ ***silver chloride***

d. $K_3N_{(s)}$ ***potassium nitride***

e. $SnBr_{2(s)}$ ***tin (II) bromide***

4. Write the following chemical formulas.

   a. zinc sulfide ***ZnS***

   b. cobalt (III) chloride ***$CoCl_3$***

   c. barium bromide ***$BaBr_2$***

   d. aluminum oxide ***Al_2O_3***

   e. chromium (II) iodide ***CrI_2***

Naming Molecular Compounds

Molecular compounds have non-metallic elements. Sucrose ($C_{12}H_{22}O_{11(s)}$), which has the common name of sugar, is a molecular compound. Instead of transferring electrons and forming ions, molecular elements share electrons to become stable. They can be either solid, liquid, or gas at room temperature.

Naming molecular compounds made of only two elements is similar to naming ionic compounds. The first element name stays the same and the second element ends in **ide**. The compound name is also written in all lowercase letters. However, without any ions present, we have to identify the number of atoms of each element with a prefix.

Number of Atoms	Prefix
1	mono
2	di
3	tri
4	tetra
5	penta

For example, the molecular compound $N_2O_{5(g)}$ is named dinitrogen pentaoxide. You do not need to use the prefix **mono** if there is only one atom of the first element. An example is $CO_{2(g)}$ which can be identified as carbon dioxide

To write the chemical formula of a molecular compound you must convert the prefixes that identify the number of atoms of an element. For example, the compound sulfur dioxide has the formula $SO_{2(g)}$.

Read pages 152-153 of *Science in Action 9*.

5. Name the following chemical compounds.

   a. $CCl_{4(l)}$ ***carbon tetrachloride***

   b. $SiO_{2(s)}$ ***silicon dioxide***

   c. $P_2O_{5(s)}$ ***diphosphorus pentaoxide***

   d. $N_2O_{(g)}$ ***dinitrogen monoxide***

6. Write the chemical formulas for the following compounds.

   a. diphosphorus pentasulfide ***P_2S_5***

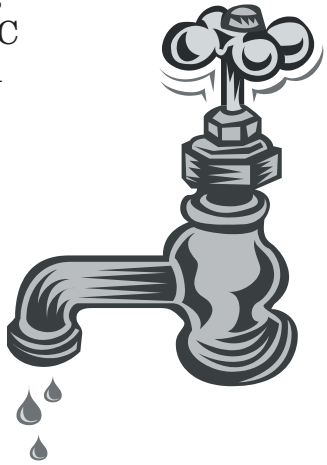
   b. sulfur trioxide ***SO_3***

   c. chlorine dioxide ***ClO_2***

   d. phosphorus trichloride ***PCl_3***

Common Names of Chemical Formulas

Did you know that dihydrogen monoxide, H_2O, has the common name of water? Before IUPAC began standardizing chemical names, common names of compounds were used. Another example of this is the compound bleach, which has a standardized name of aqueous sodium hypochlorite ($NaOCl_{(aq)}$).



Here are some common compounds whose chemical formulas you should know.

Chlorine gas ($Cl_{2(g)}$) is used in water treatment facilities.

Limestone, which is also known as calcium carbonate ($CaCO_{3(s)}$), is used to make cement, mortar, and chalk.

Baking soda, which is known as sodium hydrogen carbonate ($NaHCO_{3(s)}$), is used for baking.

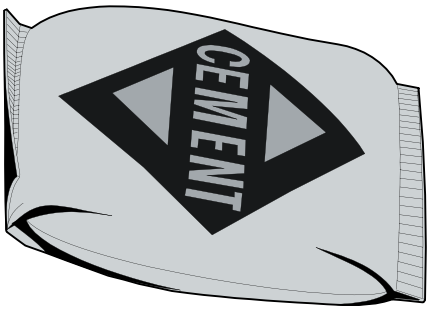
Oxygen ($O_{2(g)}$) is a necessary component of the air we breathe.

Ozone ($O_{3(g)}$) is a gas in the atmosphere that protects us from ultraviolet light.

Iodine ($I_{2(s)}$) is used to disinfect wounds.

Natural gas, which is known as methane ($CH_{4(g)}$), is used to heat our homes in the cold weather.

Road salt, which is known as calcium chloride ($CaCl_{2(s)}$) is used to melt ice and snow on the roads.



Read pages 506-507 of *Science in Action 9*.

7. Identify the following compounds as ionic or molecular.

   a. water ***molecular***

   b. bleach ***ionic***

   c. chlorine gas ***molecular***

   d. limestone ***ionic***

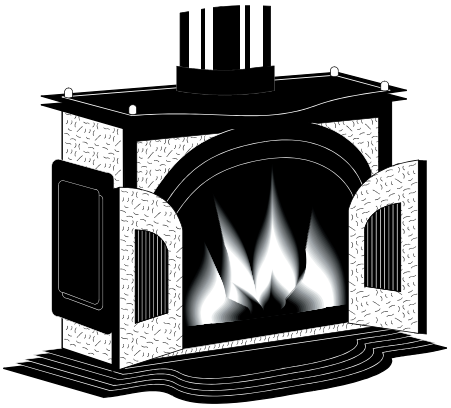
   e. baking soda ***ionic***

   f. oxygen gas ***molecular***

   g. natural gas ***molecular***

   h. road salt ***ionic***

Writing Chemical Equations



In a chemical reaction, reactants combine to form products. The reactants of the reaction are found on the left side of the equation and the products are found on the right side of the equation. Here is a sample chemical reaction. Natural gas is burned in a furnace to produce heat.

The reactants are methane and oxygen. The products are carbon dioxide, water, and heat energy. The word equation of this reaction is as follows.

methane + oxygen $\Longrightarrow$ carbon dioxide + water + heat energy

The chemical equation of this reaction is

$$CH_{4(g)} + O_{2(g)} \Longrightarrow CO_{2(g)} + H_2O_{(g)} + \text{heat energy}$$

Read pages 506-507 of *Science in Action 9*.

8. Identify the products and write the word equations for the following reactions.

a. $Al_{(s)} + O_{2(g)} \Longrightarrow Al_2O_{3(s)}$

Products: ***$Al_2O_{3(s)}$***

aluminum + oxygen $\Longrightarrow$ ***aluminum oxide***

b. $CaCO_{3(s)} \Longrightarrow CaO_{(s)} + CO_{2(g)}$

Products: ***$CaO_{(s)} + CO_{2(g)}$***

calcium carbonate $\Longrightarrow$ ***calcium oxide + carbon dioxide***

c. $H_2O_{(g)} \Longrightarrow H_{2(g)} + O_{2(g)}$

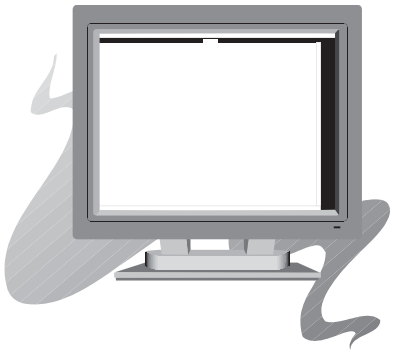
Products: ***$H_{2(g)} + O_{2(g)}$***

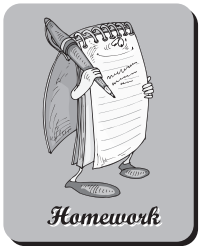
water $\Longrightarrow$ ***hydrogen + oxygen***

Internet Websites

The addresses for the website below was valid at the time of printing.

http://www.chem.purdue.edu/gchelp/nomenclature/vary_charge.htm





Homework

9. Remove the skin from an apple and slice two identical pieces of it. Leave one piece of the apple in the air. Crush or open up a vitamin C tablet and sprinkle the powder on the second piece. Describe what happens to each piece of apple after an hour or so.

The plain apple turns brown (undergoes oxidation)

The apple with the vitamin C should not turn brown.

10. Pour a quarter cup of vinegar into a narrow glass. Add two teaspoons of baking soda to the vinegar. Describe what happens.

Bubbles are produced. (Carbon dioxide gas is being released.)