CHAPTER 12

Teaching Suggestions

Science and Mathematics Lab

(Course 3, Lesson 1-8)

Chemical Solutions

OVERVIEW

This activity provides students with an opportunity to learn some basic chemistry, to become familiar with chemical symbols, and to recognize how some atoms interact with each other. It also allows students to practice reading word problems and to write algebraic equations from the information provided. Students will be required to solve these equations.

RECOMMENDED TIME

1 class period

MATERIALS

- Styrofoam balls of various sizes
- colored markers
- toothpicks
- drinking straws

PREPARATION

Obtain the materials and experiment with molecule building. Although atoms occupy certain positions within a molecule, this aspect of chemistry will not be stressed in this activity.

TEACHING THE LAB

1. Quiz students on chemical names and symbols to help them become familiar with the language of chemistry.
2. Remind students that chemical equations are similar to algebraic equations in that each must always balance.

Teaching Suggestions

Science and Mathematics Lab

(Course 3, Lesson 1-8)

Chemical Solutions (continued)

Answers and Conclusions

1. $24 = 12 + x, x = 12$ chlorine atoms

2. $36 = 12 + x, x = 24$ oxygen atoms

3. $16 = 8 + x, x = 8$ potassium atoms

4. $16 = 4 + x, x = 12$ helium atoms

EXTENSION

$36 = 24 + x, x = 12$ sodium atoms

CHAPTER 12

Name _____ Date _____

Science and Mathematics Lab

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Chemical Solutions

INTRODUCTION

All matter is made of *atoms.* Atoms are pure substances that cannot be broken down into simpler substances by chemical reactions. Atoms are composed of an inner nucleus of protons and neutrons and an outer shell of electrons. When atoms combine, they form *molecules.* Every molecule has a specific number of different types of atoms. For example, water is made of two atoms of hydrogen and one of oxygen. It is written in chemical symbols as H_2O.

OBJECTIVES

In this lab, you will:

- determine the numbers of different atoms that make up certain molecules.
- write algebraic equations and solve them for different molecules.

MATERIALS

- Styrofoam balls of various sizes
- colored markers
- toothpicks
- drinking straws

PROCEDURE

1. Color the Styrofoam balls according to the table below.

Atomic Name	Symbol	Color
Hydrogen	H	Yellow
Helium	He	Green
Carbon	C	Blue
Nitrogen	N	Black
Oxygen	O	Red
Sodium	Na	Brown
Chlorine	Cl	Orange
Potassium	K	Pink

Name _____ Date _____

Science and Mathematics Lab

(Course 3, Lesson 1-8)

Chemical Solutions (continued)

2. Use toothpicks to assemble molecules of water (H_2O), salt (NaCl), sodium hydroxide (NaOH), nitrate (NO_3), carbon dioxide (CO_2), hydrochloric acid (HCl), and ammonia (NH_3).

3. Now use your straws to connect your molecules and atoms into crystals of sodium chloride, NaCl (use 4 molecules); ammonium chloride, NH_4Cl (use 2 molecules of HCl and 2 molecule of NH_3); and carbon tetrachloride (*Hint: tetra* means 4).

4. Now that you have an idea of how atoms make up molecules, which in turn make up larger molecules or crystals, you will write and solve some algebraic equations about chemical formulas.

For example, if a crystal composed of hydrogen and oxygen has 15 atoms and 5 of these are oxygen, how many atoms are hydrogen?

$$\begin{aligned} 15 &= 5 + x \\ 15 - 5 &= x \\ 10 &= x \end{aligned}$$

What kind of crystal do you think this is? Answer: an ice crystal made of 5 molecules of H_2O

Questions and Conclusions

1. Write and solve an equation for a crystal of salt (NaCl) that has 24 atoms, 12 of which are sodium.

2. Write and solve an equation for a crystal of dry ice (CO_2) that has 36 atoms, 12 of which are carbon.

3. How many atoms of potassium are in a solution of potassium chloride (KCl) that has a total of 16 atoms?

4. A balloon is usually filled with helium (He). If the helium gas in a balloon is contaminated with $\frac{1}{4}$ nitrogen and a sample of the gas has 16 atoms, how many atoms are helium?

EXTENSION

A solution of sodium hydroxide (NaOH) will neutralize a solution of hydrochloric acid (HCl). One molecule of NaOH will neutralize 1 molecule of HCl. If you have a neutral solution of these 2 molecules in which there are 24 atoms of hydrogen, how many sodium atoms do you have?