

Teaching Suggestions

Science and Mathematics Lab

(Course 2, Lesson 12-3; Course 3, Lesson 7-5)

Getting Gas from Water

OVERVIEW

This activity provides students with the opportunity to measure, calculate, and compare volumes.

RECOMMENDED TIME

1 class period

MATERIALS

- 250-mL beaker
- 6-V lantern battery
- 2 pieces of wire, 15 cm long
- 2 test tubes or small cylindrical vials
- acidified water
- metric ruler

PREPARATION

Add 10–20 drops of sulfuric acid, H_2SO_4 , to a liter of water to prepare the acidified water. The acidity enables the water to conduct electricity better. Wear safety goggles, a lab apron, and gloves when working with sulfuric acid.

TEACHING THE LAB

1. In this lab, students calculate the total volume of a test tube and estimate the volume of hydrogen and oxygen produced by the electrolysis of water.
2. Have students work in pairs. Each student should measure the gas generated in the tubes.
3. Make sure each student wears safety goggles when working with the acidified water. Do not allow students to work with sulfuric acid.

Teaching Suggestions

Science and Mathematics Lab

(Course 2, Lesson 12-3; Course 3, Lesson 7-5)

Getting Gas from Water (continued)

4. Demonstrate the correct way of putting a completely filled test tube or vial into a beaker of water. First, completely fill the test tube with water. Then place your finger over the top of the test tube, invert the tube, and insert it into the beaker. There should be little or no air in the test tube.
5. Remind students to wash their hands thoroughly after placing the tubes into the beaker and after they have finished the lab.

Answers and Conclusions

1. Sample answer: The volume of each test tube is 17.7 cm^3 .
2. test tube A
3. Answers will vary, but students should say they will get about two times as much hydrogen.
4. Answers will vary, but students should get twice as much hydrogen as oxygen.
5. Answers will vary, but students should report about 4 times each volume they collected.

Science and Mathematics Lab

(Course 2, Lesson 12-3; Course 3, Lesson 7-5)

Getting Gas from Water

INTRODUCTION

Hydrogen and oxygen atoms are some of the most abundant atoms on Earth. Both of these elements occur as gases in the atmosphere. However, when hydrogen and oxygen are chemically combined, they form water (H_2O)—a liquid essential for life. Water can be broken down into gaseous hydrogen and oxygen by passing an electric current through it. This type of reaction is known as *electrolysis*.

OBJECTIVES

In this lab, you will:

- separate water into hydrogen and oxygen gases and calculate the volume produced by each.
- compare the volumes of hydrogen and oxygen produced by the reaction.

MATERIALS

- 250-mL beaker
- 2 test tubes or small cylindrical vials
- 6-V lantern battery
- acidified water
- 2 pieces of wire, 15 cm long
- metric ruler

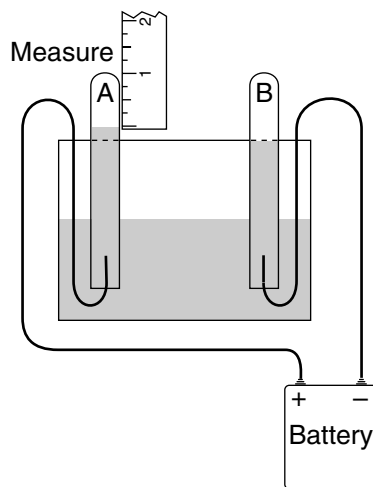
PROCEDURE

1. Put on safety goggles. Work with a partner to fill the 250-mL beaker about two-thirds full of acidified water.
2. Label one test tube A and the other B.
3. Completely fill the two test tubes with acidified water. Hold your finger over the top of one of the test tubes, invert the tube, and place it into the beaker. Do not remove your finger until the mouth of the test tube is under water. If your test tube has air bubbles in it, remove it and repeat the procedure with the other test tube.
4. Connect a wire to the positive terminal of the battery. Bend the wire so that you can place it in the beaker and into the mouth of test tube A. Repeat the procedure for the negative terminal and place the wire into test tube B. You should see a stream of bubbles coming from each wire.

Science and Mathematics Lab

(Course 2, Lesson 12-3; Course 3, Lesson 7-5)

Getting Gas from Water (continued)



- Note the time. After 30 minutes, measure the amount of gas in each test tube.

DATA AND OBSERVATIONS

Assume that each test tube is a cylinder.

Test Tube	Height	Diameter	Volume
A			
B			

Questions and Conclusions

- Calculate the height, diameter, and volume for each test tube and record them in the Data Table. The formula for volume of a cylinder is $V = \pi r^2 h$.
- Which test tube had the greater volume of gas?
- Water has a chemical formula of H_2O . The subscript indicates the number of atoms in the water molecule. How much more hydrogen do you expect to get from breaking down the water?
- How does the volume of oxygen compare to the volume of hydrogen?
- If you left this experiment running for 2 hours, how much volume of each gas would you collect?