Pringles® Can Rocket

Hydrogen and Oxygen Explosions

Introduction

An empty Pringles potato chip can is filled with hydrogen gas and ignited. The hydrogen burns with a yellow flame for about one minute. As the air mixes with the hydrogen the flame will become smaller and smaller. Just before the mixture explodes a slight whistling can be heard. When the mixture explodes the plastic lid on the bottom will fly off and the can will shoot about 10 feet in the air.

Concepts

- Hydrogen gas
- Combustion
- Stoichiometry

Materials

Aluminum foil, 3″ × 3″ piece (optional)
Sodium hydroxide, 6 M, 150 mL (optional)
Balloon
Buret clamps, 2 (optional)
Clay triangle
Florence flask, 500-mL (optional)
Hydrogen gas, lecture bottle
Pipet, Beral-type
Pringles can
Ring clamp
Ring support stand
Stopper, one-hole, #6

Safety Precautions

This is not a demonstration for the inexperienced teacher. The production of the hydrogen is the most dangerous part. Hydrogen is a very flammable and potentially explosive gas but can be safely handled with proper safety procedures. Never generate hydrogen in a closed system—always make sure there are no plugs or blockages in the system. Remove all sources of sparks, flames, and heat from the area where hydrogen gas is produced or used.

Sodium hydroxide is a very corrosive to all body tissues, especially eyes. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. The reaction between sodium hydroxide and aluminum starts slowly and then proceeds rapidly with the production of excessive heat. If the reaction is allowed to proceed too vigorously, it will produce both steam and hydrogen gas and may even boil up out of the reaction flask. Slow the reaction by immersing the reaction flask into an ice water bath. Keeping the reaction cool and producing a slow, steady stream of hydrogen is both safer and produces a drier gas. Do not scale this procedure up.

Make sure there is ample room above the demonstration area for the flying can and remove all flammable/combustible materials from the area prior to lighting the rocket. The presenter and all audience participants must wear safety glasses or goggles.

Procedure

1. With a nail, make a hole in center of the metal bottom of a Pringles can. Make sure the Florence flask is borosilicate glass.
2. With a stopper borer, make another hole the size of a pencil in the center of the plastic lid.
3. Either use a cylinder of hydrogen, or generate hydrogen in the following manner:
   a. Fill a 500-mL Florence flask with about 150 mL of 6 M NaOH.
   b. Wad a large piece (approximately 3″ × 3″) of aluminum foil into a small ball that will fit inside the flask.
   c. Have another container with ice water nearby to immerse the Florence flask once the reaction becomes vigorous and the water starts to boil.
   d. Clamp the flask to the ring stand.
   e. Place a balloon over the flask, to collect the hydrogen.

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f. Add the aluminum foil to the sodium hydroxide and the hydrogen gas production will begin in about a minute.

g. Make sure that the balloon contains at least twice the volume of the Pringles can; it should be as large as a basketball.

4. Place the Pringles can on a clay triangle supported by an iron ring, making sure the plastic lid end is down.
5. Cut the end off of the bulb of a plastic Beral-type pipet. Insert the bulb-end of the pipet into the balloon containing the hydrogen gas. The end of the pipet should fit inside the hole in the metal end of the Pringles Can.
6. Fill the Pringles can up with hydrogen gas from the top (metal bottom) of the can. Remember, hydrogen is lighter than air.
7. When the can is full, remove the balloon and quickly seal the hole with your finger. Remove all flammable materials.
8. Remove your finger from the hole and with a fireplace match, light the hydrogen that will now be coming out of the hole in the top of the can. (Be prepared, if you did not completely fill the can, it may explode as you light it.)
9. The flame will burn for 10–30 seconds. Just before the can explodes, a very quiet high-pitched whistle will be heard as the air rushes into the can as the hydrogen gas is being used up faster and faster.

THE EXPLOSION WILL OCCUR VERY SHORTLY.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. Materials may be rinsed down the drain with plenty of water according to Flinn Suggested Disposal Method #26b. Excess sodium hydroxide solution may be neutralized according to Flinn Suggested Disposal Method #10.

Tips

- Practice this demonstration before you attempt to do it in front of an audience.
- The balloon should contain at least 2–3 times the quantity of hydrogen needed to fill the can.
- Warn students to cup their ears before the explosion—it is surprisingly loud!
- Avoid telling your students that one of the chemicals needed for this demonstration is sodium hydroxide. The reaction is easily performed and sodium hydroxide (lye) is also readily available. Hydrogen-filled bottles and caustic sodium hydroxide can be a problem in untrained hands.
- Many teachers prepare the hydrogen gas before class and store the hydrogen gas in a balloon until use.

Discussion

As the hydrogen is consumed, the flame will get smaller and smaller and oxygen will be drawn in through the hole in the bottom of the can. When the proper combustion mixture of hydrogen and oxygen forms, there will be a loud explosion, the plastic lid will be blown off, a flame will appear, and the can will fly about 6–10 feet into the air.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Constancy, change, and measurement
Content Standards: Grades 9–12
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter, chemical reactions, interactions of energy and matter
Content Standard F: Science in Personal and Social Perspectives, natural and human-induced hazards, science and technology in local, national, and global challenges

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Pringles® Can Rocket* activity, presented by Irwin Talesnick, is available in *Hydrogen and Oxygen Explosions*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Pringles® Can Rocket* are available from Flinn Scientific, Inc.

Catalog No.	Description
LB1015	Hydrogen Gas Lecture Bottle
AP8228	Support Stand, 6″ × 9″
AP1320	Ring, Support, with Rod Clamp, 3″
LB1051	Lecture Bottle Control Valve, Brass
AP8331	Triangle, Pipe Stem

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.