

Self-Carving Pumpkin

Introduction

Carving a pumpkin has never been such a blast! Students will be astonished as small pieces fly off the pumpkin to reveal a face.

Concepts

- Chemical reactions
- Thermochemistry
- Combustion reaction

Materials

Calcium carbide, CaC_2 , 2 g

Water, 50 mL

Carving tool

Beaker, plastic, 100-mL

Electronic Balance

Forceps

Piezoelectric igniter

Plastic cup

Pumpkin, approx. 10 × 10



Safety Precautions

When calcium carbide is exposed to water or moisture it evolves flammable acetylene gas that is corrosive to eyes and skin. Perform this demonstration in a well-ventilated area only. Make sure there are no flames in the area. Use only a piezoelectric igniter to ignite the acetylene in the pumpkin. Keep a fire extinguisher on hand and do NOT scale up the demonstration. Since this reaction does produce a small explosion, make sure students are wearing safety goggles and are at least 15 feet away from the pumpkin at the time of the demonstration. Warn students to “cup” or cover their ears. Wear safety goggles, chemical-resistant gloves and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Follow all laboratory safety guidelines. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Read the entire procedure before performing this activity.
2. Verify the piezoelectric igniter is working in a well-ventilated area. You should see a small blue spark at the end of the wire.
3. Carve a medium-sized pumpkin. Simple shapes are best—don't carve anything too fancy. Scoop out the seeds.
4. Carve a hole in the back of the pumpkin about 2" in diameter. *Note:* This will be used to insert the wires of the piezoelectric igniter.
5. Replace the eyes, nose, and mouth pieces in the pumpkin. From a distance the pumpkin should appear that it has not been carved.
6. Place a 100-mL plastic beaker containing 50 mL of water in the center of the pumpkin where a candle would normally be found.
7. Using an electronic balance, measure out 2 g of calcium carbide.
8. Drop 2 g of calcium carbide into the 50 mL of water in the beaker. Place the top back on the pumpkin.
9. Slide the two wires of the piezoelectric igniter in the hole in the back of the pumpkin to be used for a spark.
10. Wait approximately 30 to 45 seconds and then spark the piezoelectric igniter inside the back opening on the pumpkin. The time depends on the size of the pumpkin—the larger the pumpkin, the longer the time. *Note:* If the explosion does not occur by 60 seconds, try sparking every 10 seconds up to two minutes.
11. If the reaction still does not occur, open the top of the pumpkin, remove the beaker, and place it in a fume hood. Once all the CaC_2 has reacted, treat as directed in the *Disposal* section. Meanwhile, repeat the experiment (steps 5–10) using 2.5 g CaC_2 .

12. Upon ignition, the eyes, nose, and mouth of the pumpkin will fly out accompanied by a loud explosion, flames, and black smoke.
13. After the reaction, carefully remove the beaker from the inside of the pumpkin and place it in a fume hood. Flammable acetylene gas is still forming and should not be inhaled.

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. After calcium carbide has reacted with the water, a basic solution is produced. Neutralize solution with 3 M hydrochloric acid and check with pH paper according to Flinn Suggested Disposal Method #10. Decant the neutral solution and flush it down the drain with at least a 20-fold excess of water. Dry any precipitate in the beaker and place in the trash according to Flinn Suggested Disposal Method #26a.

Tips

- This experiment works best with a medium- to large-sized pumpkin. A small pumpkin often creates too small of a work space and an excessively large pumpkin will take longer to “carve itself.”
- Use only a piezoelectric igniter with an 8" cord for this experiment. NEVER use matches or small pocket lighters—they pose serious risk to the demonstrator.
- Do not scale-up this demonstration. This could pose serious danger to the presenter as well as the observers.

Discussion

Calcium carbide, CaC_2 , is primarily used to produce acetylene gas. Acetylene gas is a product of reacting calcium carbide with water. This reaction was utilized in carbide (miners') lamps where water dripped on the carbide producing acetylene gas that was ignited (see Equation 1). These lamps were commonly used in slate, copper, and tin mines. Since acetylene gas is highly flammable, the carbide lamps were not used in coal mines, where they would be a serious hazard. Most carbide lamps have been replaced today by electric LED lamps.



Acetylene consists of two hydrogen atoms and two carbon atoms attached by a triple bond (see Equation 2). Acetylene is often found as the fuel in torches as it burns brilliantly in air with a very sooty flame. It has a very high heat of combustion (1300 kJ/mole) and burns with a very hot flame.



Acknowledgment

Special thanks to Lee Marek, retired, Naperville North High School, Naperville, IL.

References

O'Neil, Maryadele J. *Merck Index*; Merck & Co., Inc.: Whitehouse Station, NJ; 2006; Edition 14, p. 16.

Materials for *Self Carving Pumpkin* are available from Flinn Scientific, Inc.

Catalog No.	Description
C0346	Calcium Carbide, 100 g
AP6286	Piezoelectric Igniter

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