“Instantly Carving” Pumpkin

An Advanced Level Demonstration

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Introductuion:

A pre-carved pumpkin with the pieces replaced will seem to be carved instantly when an acetylene/air mixture inside the pumpkin is ignited. Calcium carbide placed inside the pumpkin will react with water to produce the acetylene gas. Ignite the mixture with a spark or flame lighter and a enjoy an Instantly Carved Pumpkin. Oh, and it will make a pretty loud boom, too!

Background:

This demonstration involves two separate chemical reactions:

First, the reaction of Calcium Carbide and Water to produce Acetylene gas and secondly, the combustion of Acetylene and Oxygen (from the air).

Materials:

- Pumpkin, full sized (each pumpkin will provide 4 or 5 demos but always have a spare on hand.
- Calcium carbide, 2 g for each demonstration (Flinn Scientific and other online science supply stores)
- Water, 10 ml per demo
- Aluminum foil
- Spark or flame lighter (or meter stick with match or wood splint attached)
- Safety Shield / Goggles / Gloves / hearing protection (optional)

Setup:

1. Before the demo, carve out the pumpkins by removing the "guts" and carving a face. Be careful not to break the carved out pieces; they will be replaced into the pumpkin. Note: The pumpkin pieces should be as air tight as possible. Also, the face pieces and top should be cut with a taper so that they easily slide in and out of their positions, but will stay in place if left alone.

2. Carve a small, opening in the back of the pumpkin just large enough for the spark or flame lighter (or meter stick with match or wood splint attached). This opening is for the ignition of the gas and should be on the lower part of the pumpkin.

3. Make a small boat out of the aluminum foil large enough to hold 10 ml of water.

4. Measure out the 2 g of calcium carbide and place in the aluminum foil boat. Place this inside the pumpkin.

5. Measure 10mL of water in a large dropping pipette (or small funnel with rubber tubing that reaches down to the aluminum foil boat).

6. Place the pumpkin behind a safety shield made from 1/4 in thick plexiglass (available on Amazon) and a wooden or other solid base.

The Demonstration:

1. Wearing safety goggles or face shield and protective gloves, add water to the Calcium Carbide and replace the pumpkin cover. The reaction to produce Acetylene will begin immediately.

2. Allow between 15 and 30 seconds for the gas to accumulate inside the pumpkin and the reaction to complete. Practice to find the best wait time for the size of your pumpkin and the quality of Calcium Carbide.

3. Insert the spark or flame lighter (or meter stick with burning match or splint) into the back of the pumpkin and ignite the Acetylene!

4. Some pieces of the pumpkin interior may become scorched or catch on fire. Using water to put out the fire is not a good idea since some calcium carbide may remain. Instead, try blowing out or smothering the flames.

Trouble shooting:

Common problems are:

1. A less than dramatic explosion or no explosion at all. This may be fixed by adding more calcium carbide, and/or allowing more time for the pumpkin fill with gas. Note: allowing too much time might might generate too much acetylene which could replace the air leaving too little oxygen for combustion. Practice with no students present fine tune your technique.

2. The pumpkin explodes but the pieces are not ejected completely. Using a thin knife, make sure the pieces can freely slide out of the face. Also, holding down the lid during ignition (with a gloved hand) will increase the force pushing out the pumpkin pieces.

Safety:

1. Practice demo without students present.

2. Wear eye and hand protection.

3. Use a safety shield.

4. DO NOT use a glass beaker for holding the Calcium Carbide and water. The beaker could break with the force of the explosion.

5. Measure amounts of Calcium Carbide and Water. Only increase amounts by small increments.

6. Keep students at least 10 feet from demo with safety shield in place.

Follow up:

You now have your students' attention. Take advantage of the moment to generate discussion of what just happened and why.

Chemical Reactions:

Production of Acetylene: $CaC_2 + 2\ H_2O \rightarrow C_2H_2 + Ca(OH)_2$

Combustion of Acetylene: $2\ H_2C_2 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$