

Exploding Pumpkin Performer's Version

Safety Hazards

- Personal Protective Equipment:
 - Safety glasses/goggles
 - Nitrile gloves
 - Work gloves
 - Chemical & flame retardant lab coat
 - Hearing protection
- Physical Hazards
 - Explosive reactions can cause serious injury and/or severe burns to the skin and/or eyes.
 - Calcium carbide, when in contact with water, releases flammable gasses which may ignite spontaneously; catches fire spontaneously if exposed to air.
 - Acetylene is highly flammable; under pressure may explode if heated and/or form explosive mixtures with air.
 - Pumpkins have a relatively soft body that may result in projected pieces. Maintain a safe distance when performing this

demonstration and prepare it no less than 15 feet away from the audience.

- Chemical Hazards
 - Calcium carbide may cause serious respiratory irritation, eye damage, and skin irritation.
 - Calcium hydroxide may cause serious respiratory irritation, eye damage, and skin irritation.
 - Acetylene may cause serious respiratory damage.

Materials

- 1 pre-carved pumpkin
- 2g calcium carbide
- Water
- BBQ lighter
- Large weigh boat

Safety Data Sheet(s):

- [Calcium carbide](#)
- [Acetylene](#)
- [Calcium hydroxide](#)

Procedure

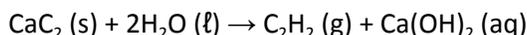
Someone from the Demonstrations team must be present in order for this demonstration to be performed.

1. Place the pumpkin on the table so that it is positioned to not directly face the audience. Make sure the table is at least 15 feet away from the audience. Position the pumpkin such that the small hole drilled in the back is not directly facing you but is easily accessible.
2. Take off the lid of the pumpkin and place the large weigh boat in the center.
3. Pour the calcium carbide into the weigh boat.
4. Wearing a work glove, hold the lid of the pumpkin in one hand and pour about 2 mL of water into the weigh boat. Quickly close the lid of the pumpkin and hold it down firmly (with the work glove hand).
 - a. *Note: The acetylene gas has a clear odor when it has formed, which is a great indication that the pumpkin is ready to be ignited. You may also hear a hissing/sizzling sound as gas is generated.*
5. Using the lighter, ignite the gas inside of the pumpkin from the hole on the back. The lighter does not need to go *inside* the cannon – close to the hole should still ignite the gas.

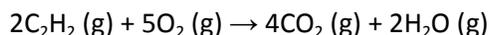
Pedagogy & Supplemental Information

Calcium carbide is a versatile grayish-white crystalline solid, typically produced industrially. Calcium carbide has several applications; it is utilized in the production of calcium cyanamide, a nitrogen fertilizer and is also employed as a desulfurizing agent in the steel industry, where it can react to form and subsequently remove calcium sulfide from molten steel. Calcium carbide also finds use in the manufacture of various organic chemicals and as a ripening agent for fruits, where it produces ethylene gas, hastening the ripening process. Mostly commonly, though, calcium carbide is used in the generation of acetylene gas.

When calcium carbide reacts with water, it undergoes hydrolysis to produce acetylene gas and calcium hydroxide. The chemical equation for this reaction is:



This reaction releases a considerable amount of heat and is highly exothermic. Acetylene gas itself is highly flammable and forms explosive mixtures in air. When ignited, acetylene undergoes combustion with oxygen to produce carbon dioxide and water vapor, releasing a large amount of thermal energy. The combustion of acetylene is represented by the equation:



Historically, acetylene gas was used in portable lighting devices such as miners' lamps. When acetylene gas is burned with oxygen, it produces a bright, steady flame, making it suitable for illumination in remote or underground locations where electricity was unavailable. More recently, the flammable gas has been used in the welding/cutting industry as well as for chemical synthesis. Acetylene, when mixed with oxygen and ignited, produces a high-temperature flame suitable for welding and cutting metals. Oxy-acetylene welding and cutting processes have been widely used in metalworking industries for decades due to the versatility of the flame and its ability to rapidly melt and fuse metal parts. Acetylene also serves as a precursor in the synthesis of various organic chemicals, like vinyl chloride and acetaldehyde. Vinyl chloride is a key ingredient in the manufacturing of polyvinyl chloride (PVC) plastics, whereas acetaldehyde finds applications in perfumes, dyes, and pharmaceuticals.