

Giant Alcohol Cannon

Combustion of Alcohols

Background

This demonstration is an excellent way to show the flammability of ethanol vapors. When a flame is brought near the ignition hole of a “charged” cannon, the foam ball can be shot 50–60 feet away! Teachers must be sure to exercise proper safety precautions, but this demonstration is just too good to pass up! The PVC pipe materials are inexpensive and readily available from Home Depot, and the foam balls are commonly found at toy stores and Walmart.

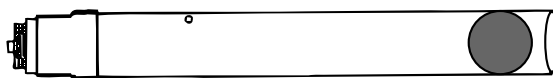


Figure 1.

Concepts

- Thermochemistry
- Activation Energy
- Exothermic Reactions
- Pressure

Materials (for each demonstration)

Ethyl alcohol, C_2H_5OH , 5 mL	Nerf® soccer ball, 7" diameter (or 7" Poof Products foam ball)
Beral pipet, 2	PVC Cleaner
Butane safety lighter	PVC Cement
Drainpipe (5' L \times 4"W)	Schedule 30 PVC-DWV fitting cleanout w/threaded plug, 3" (Home Depot #61630)
Drill with $\frac{3}{8}$ -inch bit	Schedule 30 PVC-DWV sewer pipe adapter, 4" \times 3" (Home Depot #61543)

Safety Precautions

Ethyl alcohol is a dangerous fire risk; flammable. Addition of denaturant makes the product poisonous—it cannot be made non-poisonous. It is strongly recommended that this demonstration should only be performed outside or in a large gymnasium. Additionally, teachers should instruct students to stand clear of the cannon to avoid the ball as it propelled from the drainpipe. Wear safety goggles and hearing protection while performing the demonstration.

Preparation

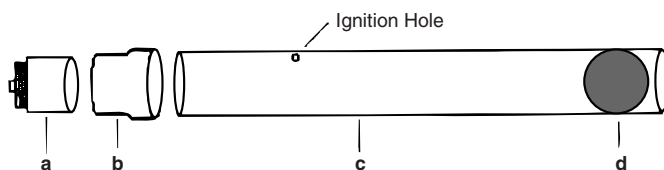


Figure 2. Components of the alcohol cannon.

- a = Schedule 30 PVC-DWV fitting clean out with threading plug
b = Schedule 30 PVC-DWV sewer pipe adapter
c = Drainpipe
d = Ball

1. Wipe the end of the drainpipe with PVC cleaner.
2. Apply a liberal amount of PVC cement to each surface to be connected.
3. Push the sewer pipe adapter (b) onto the end of the drainpipe (c). Make sure that the adapter has been fully inserted onto the outer surface of the drainpipe.
4. Attach the fitting cleanout (a) to the adapter (b). Use the PVC cleaner and cement as before.
5. Allow the pipe to dry for 24 hours to insure the cement has completely cured before proceeding.
6. Drill a $\frac{3}{8}$ " hole about 10–12 inches from the end of the pipe that has the PVC fittings. This should allow you to comfortably hold the cannon and Aim & Flame sparking device.

Procedure

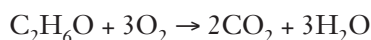
1. Add about 2 mL of ethanol to the top of the cannon. Squirt it into the barrel of the cannon below where the foam ball will be inserted.
2. Quickly compress a 7-inch diameter foam ball into the end of the pipe. The ball should be completely inside the pipe.
3. Use a plastic pipet to squirt about 2 mL of alcohol through the ignition hole.
4. Spin the cannon to assist in vaporizing the alcohol. After 3–4 minutes, the alcohol should have evaporated and the cannon is now ready to fire.
5. Point the cannon away from people, and insert the wired Aim & Flame into the ignition hole. A mild “thump” will send the ball flying about 50–60 feet!

Tip

- A suitable 6–7" soft poof ball may be found and purchased from Flaghouse.com.

Discussion

Teachers can use this demonstration to discuss many different concepts. The basic reaction that occurs inside the pipe is:



Connecting to the National Standards

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

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

Content Standards: Grades 5–8

Content Standard B: Physical Science, properties and changes of properties in matter, motions and forces, transfer of energy

Content Standards: Grades 9–12

Content Standard B: Physical Science, structure and properties of matter, chemical reactions, motions and forces, conservation of energy and increase in disorder, interactions of energy and matter

Acknowledgement

Presented by chemistry teacher Kathleen Holley at the ACT-2 Conference, Belton, Texas, June, 2001. This demonstration appears in “*Chemistry Demonstration Aids That You Can Build!*” that is published by Flinn Scientific. The Flinn catalog number for this book is AP9320.

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Giant Alcohol Cannon* activity, presented by Jeff Bracken, is available in *Combustion of Alcohols* and in *Energy in Combustion Reactions*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Giant Alcohol Cannon* are available from Flinn Scientific, Inc.

Catalog No.	Description
E0009	Ethyl Alcohol, 95%, 500 mL
AP1721	Beral-Type Pipet, Graduated, 20
AP8960	Butane Safety Lighter

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