

Alcohol Vapor Explosion

A small amount of the ethanol liquid in the bottle vaporizes, and the vapor produces an explosive mixture with oxygen in the air. This spark inside the bottle detonates the mixture of alcohol vapor and air, causing the cork to shoot out of the bottle.

Lesson Title:	Alcohol Vapor Explosion
Length:	1 Class period, 50 minutes
Objectives:	<ul style="list-style-type: none">To demonstrate the combustion of vapors of a flammable liquid in air. This simulates the combustion process inside a gasoline engine.
Prerequisite Knowledge:	<ul style="list-style-type: none">Laboratory SafetyChemical ReactionsSafety Using Combustible Materials
References & Resources:	<ul style="list-style-type: none">Chemical Demonstrations: A Handbook for Teachers of Chemistry Vol 2; <p>Bassam Z. Shakhashiri, ed.; University of Wisconsin Press; 1985; pp 216-219.</p>
Lesson Outline:	<ul style="list-style-type: none">Materials<ul style="list-style-type: none">Two to three ml of 95% ethanolTwo nails250 ml polyethylene bottle with small neckCork to fit bottleTelsa coil or a battery charger with 2 leadsMethods<ol style="list-style-type: none">Insert one of the nails through the side of the bottle about half way up.Insert the other nail through the opposite side.Position the tips of the nails so there is a gap of about ¼ inch (0.5 cm) near the center of the bottle.Pour 2-3 ml (a layer about 1/8 inch deep) of 95% alcohol in the bottle and stopper with the cork.Set the bottle in an area free of overhead obstructions.Turn on the Telsa coil and bring its tip to one of the nails.A spark will jump to the nail and from one nail to the other.The spark inside the bottle detonates the mixture of alcohol vapor and air, causing the cork to shoot out of the bottle.This demonstration cannot be repeated without flushing the bottle with air, presumably, because the explosion consumes all the oxygen in the bottle, replacing it with carbon dioxide.
Terminology:	

Assignments:

- Discuss the fire triangle for fire prevention.
- You can use the spark plug attached to the spark plug wire on an engine as a spark to ignite the gas mixture.

Standards:

- State Goal 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.
- Learning Standard C: Know and apply concepts that describe properties of matter and energy and the interactions between them.
- Learning Benchmark 5a: Analyze reactions (e.g., nuclear reactions, burning of fuel, and decomposition of waste) in natural and man-made energy systems.
- State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.
- Learning Standard A: Know and apply the concepts, principles and processes of scientific inquiry.
- Learning Benchmark 5a: Formulate hypotheses referencing prior research and knowledge.
- Learning Benchmark 5b: Design procedures to test the selected hypotheses.