



THE SCIENCE OF “FRINGE”

EXPLORING: COMBUSTION

A SCIENCE OLYMPIAD THEMED LESSON PLAN
EPISODE 406: And Those We Left Behind

Overview:

Students will learn about combustion and how it starts and can be stopped.

Grade Level: 9-12

Episode Summary:

People begin experiencing a range of time related anomalies, such as an apartment building partially reverting back to four years ago when there was a fire. The Fringe team believes that Peter might be the cause of the time loops, and takes him to investigate. He quickly determines the events are triggered by a man-made device, and discovers a pattern to the locations at which they appear. As they rush to prevent the next event that will occur in a tunnel, they find the source is enclosed in a time bubble that they must penetrate safely.

Related Science Olympiad Event:

Thermodynamics - Teams must construct an insulated device prior to the tournament that is designed to retain heat. Teams must also complete a written test on thermodynamic concepts.

Learning Objectives:

Students will understand the following:

- Combustion is an exothermic chemical reaction involving an oxidizer and a fuel.
- The fire triangle is comprised of three things required to sustain combustion: heat, fuel, and an oxidizing agent.
- Combustion can range from very slow and low temperature, as in the case of smoldering, to very fast and hot, as in an explosion.





Episode Scenes of Relevance:

- A mother and daughter escaping the sudden apartment fire (4:09 'my favorite' – 4:58 'what is it')
- The Fringe team investigating the apartment fire (7:40 'looks like' – 9:06 '4 years ago')

Online Resources:

- Fringe "And Those We Left Behind" full episode: <http://www.fox.com/fringe/full-episodes>
- Science Olympiad Thermodynamics event: http://soinc.org/thermodynamics_c
- Wikipedia page on combustion: <http://en.wikipedia.org/wiki/Combustion>
- PBS NOVA On Fire page: <http://www.pbs.org/wgbh/nova/fire/onfire.html>
- US Fire Administration Kids: <http://www.usfa.fema.gov/kids/>

Procedures:

1. Tell your students that they are going to learn about combustion, how it starts and how it is stopped.
2. Have your students research combustion in resources such as chemistry textbooks and websites and discuss what they have learned.
3. Divide your class into small groups. Please follow all school safety rules regarding the use of flames and/or combustion. Have each group complete the following activity:
 - a. Materials: small birthday style candle, matches, baking soda, vinegar, metal fork, cups or beakers, knife
 - b. The purpose of this activity is to show how removing any one of the elements of the fire triangle will stop combustion.
 - c. Light the candle with a match.
 - d. Mix some baking soda and vinegar in a cup, which will produce carbon dioxide gas.
 - e. Pour the gas from the cup onto the candle and note it extinguishes the flame.
 - f. Next, place a match in between the tines of a metal fork.
 - g. Light the match and watch it burn until it gets to the fork, where it will stop burning.
 - h. Finally, use the knife to remove most of the wax from base of the candle (leave a tiny bit at the top).
 - i. Light the candle again and watch as it burns down and gets past the wax, burning out as a result.
4. Discuss with the class the results of the activity. Be sure to address:
 - a. In each of the three tests, which element was being removed from the fire triangle to stop combustion?
 - b. What other ways of extinguishing the flame can the class think of?

Additional Discussion Suggestions:

- Combustion can be initiated via a variety of sources other than the traditional match. Discuss some of the various ways combustion can start.
- Different types of fires are best stopped using different types of fire extinguishers. Discuss the common types of extinguishers and which element of the fire triangle each focuses on.

Extension to Other Subjects:

Literature: Words related to combustion such as flame, fire, and burning are often used in literature to symbolize other concepts. Research some examples of these and discuss why they are effective word choices.



Social Studies: Fire prevention and fighting are typically considered a fundamental public service essential to modern society. However there are many different approaches to ensuring these services are available, ranging from all volunteer forces to fully funded via tax dollars. Research some of the different approaches and why they are utilized by various societies.

History: The harnessing of combustion has been instrumental throughout history. Research several technological advances that required new applications of combustion and what impact they had on society.

National Science Standards Alignment:

M.E.1 Abilities of technological design

- b. Design a solution or product.
- c. Implement a proposed design.
- d. Evaluate completed technological designs or products.
- e. Communicate the process of technological design.