

Safety of Hydrogen

Student Objective

The student:

- will analyze the safety of gasoline vs hydrogen in vehicles

Key Words:

combustible
gaseous

Materials:

- Slides of fuel leak simulation (see Internet Sites below—eere link)

Time:

1 class period

Background Information

Many people believe hydrogen is dangerous, too dangerous to be used in society. Many use the Hindenburg disaster as one example, and the H-bomb and the first shuttle explosion as other examples. Some people know the H-bomb is made using tritium, an isotope of hydrogen. While the shuttle explosion was determined to be caused by an O-ring, it was only recently that additional information was obtained relative to the Hindenburg disaster. The new research revealed that the outside of the airship was painted with the same chemicals that make up rocket fuel!

The fuel leak simulation shows what happens when two cars, one filled with hydrogen and the other filled with gas, are ignited. In the gasoline car, the fuel line was punctured with a 1/16 inch diameter hole which enabled the gasoline to leaked out of the fuel line under the middle of the car. During the 3.5 minutes of videotaping, the vehicle leaked five pints of gasoline (approximately 70,000 BTU). During the video, the hydrogen vehicle leaked 3.4 pounds of hydrogen (approximately 175,000 BTU).

Procedure

1. Ask the students which car do they think would be safer to drive, a car fueled with gasoline or a car fueled with hydrogen?
2. Tell them they are going to look at some photos of research done at the University of Miami to answer this question.
3. Show the photos from the fuel cell leak simulation (the vidicom-tv link listed in Internet Sites below). Read the captions and explain the time frame involved.
4. After viewing the slides, ask the students again which car they would prefer to drive.
5. Lead a discussion on the difference between the two fuels in this simulation. Some points to cover are:
 - Why does the hydrogen flame go straight up? (*hydrogen gas is lighter than air*)
 - Why didn't the hydrogen ignite the car? (*it escaped quickly into the atmosphere*)

- *and burned off quickly)*
 - Why did the gasoline car have more damage? (*gasoline, being a liquid, pooled below the car, enabling it to burn longer and ignite the car*)
- 6 Lead a discussion on public perception and misinformation—how we get the wrong idea about something, how it continues, and how we can change it.

Related Research

1. What is the current research on the reason that the Hindenburg crashed? Below are a few internet sites that you might find useful in this research:
 - <http://www.vidicom-tv.com/tohiburg.htm>**
A video of the Hindenburg disaster. Needs Quicktime 5.0.2 or better.
 - <http://www.pbs.org/wnet/secrets/html/e3-chemistry.html>**
A slide show illustrating the cause of the Hindenburg disaster.
 - <http://www.nlhs.com/hindenburg.htm>**
History and photographs of the Hindenburg
 - <http://www.ch2bc.org/hindenburg.htm>**
International Clearinghouse for Hydrogen Commerce, “*The True Story of Hydrogen and the Hindenburg Disaster*” Discussion on the downing of the Hindenburg

Internet Sites

- <http://www.eere.energy.gov/hydrogenandfuelcells/pdfs/30535be.pdf>**
Dr. Michael Swain’s paper comparing two vehicle fuel leaks—a gasoline and a hydrogen leak.
- <http://evworld.com/view.cfm?section=article&storyid=482>**
Electric Vehicle World’s news coverage of Dr. Swain’s experiment

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			.1	.2	.3	.4	.5	.6
Nature of Matter	Standard 1	SC.A.1.2-	X					
	Standard 2	SC.A.2.2-						
Energy	Standard 1	SC.B.1.2-						
	Standard 2	SC.B.2.2-		X	X			
Nature of Science	Standard 1	SC.H.1.2-	X			X		
	Standard 2	SC.H.2.2-						
	Standard 3	SC.H.3.2-				X		

Benchmark SC.A.1.2.1 - The student determines that the properties of materials can be compared and measured.

Grade Level Expectations

The student:

Fourth

- uses a variety of measurements to compare and contrast the physical properties of matter

Benchmark SC.B.2.2.2 - The student recognizes the costs and risks to society and the environment posed by the use of nonrenewable energy.

Grade Level Expectations

The student:

Fourth

- knows the risk factors associated with the use of nonrenewable energy sources

Benchmark SC.B.2.2.3. - The student knows that the limited supply of usable energy sources places great significance on the development of renewable energy sources.

Grade Level Expectations

The student:

Third

- knows that alternate energy sources are being explored using natural and mechanical processes.

Fifth

- knows that the limited supply of usable energy sources places great significance on the development of renewable energy sources.

Benchmark SC.H.1.2.1 - The student knows that it is important to keep accurate records and descriptions to provide information and clues on causes of discrepancies in repeated experiments.

Grade Level Expectations

The student:

Fourth

- knows that scientists make the results of their investigations public, and they describe the investigations in ways that enable others to repeat the investigation.

Benchmark SC.H.1.2.4. - The student knows that to compare and contrast observations and results is an essential skill in science.

Grade Level Expectations

The student:

Third

- knows that to compare and contrast observations and results is an essential skill in science

Fourth

- knows that comparisons between experiments can be made when conditions are the same

Fifth

- uses strategies to review, compare and contrast, and critique scientific investigations.

Benchmark SC.H.3.2.4 - The student knows that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas.

Grade Level Expectations

The student:

Third

- knows that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas

Fourth

- knows ways that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas

Fifth

- extends and refines knowledge of ways that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas

Safety of Hydrogen

combustible - a substance that is capable of igniting and burning

gaseous - existing as or having characteristics of a gas