Lesson Topic: Fuel Cell Energy **Grade level:** 9-12
Length of lesson: 3-4 classes

Make Your Own Fuel Cell Activity

CT Science Standards:
CT SDE SCIENCE D INQ 1-10

9.1 - Energy cannot be created or destroyed; however, energy can be converted from one form to another.

9.2- The electrical force is a universal force that exists between any two charged objects.

Expected Performance- Explain the relationship among voltage, current and resistance in a simple series circuit.

9.3- Various sources of energy are used by humans and all have advantages and disadvantages.

Expected Performance-Describe the availability, current uses and environmental issues related to the use of hydrogen fuel cells, wind and solar energy to produce electricity.

Understanding (s)/goals:
Students will understand:

- How to electrolyze water.
- That Carbon acts as a catalyst and attracts Hydrogen ions.
- How hydrogen ions travel through wire and react with oxygen to create electricity and water.
- How to create a simple fuel cell.
- How to measure voltage and current of a circuit.
- How to conduct a simple scientific experiment.
- How to report findings of a simple scientific experiment.

Essential Question(s):

- Are fuel cells a viable energy source for the future?

Big Idea(s):

- Fuel cells only require hydrogen and oxygen to create electricity.
- Fuel cells create water as a product of the reaction and do not further pollute the environment.

Student objectives (outcomes):
Students will be able to:

- Create a working fuel cell.
- Create and analyze a simple circuit.
- Design a scientific experiment to manipulate one variable and compare and its effect on voltage output.

Assessment Evidence

Performance Task(s):

- Follow Teacher generated procedure and create simple fuel cells.
- Measure voltage and current from their fuel cells.
- Design a simple experiment that tests a single variable that will improve the performance of their fuel cell.
- Report the findings of their experiment specified in teacher rubric.

Plan

Learning Activities:

Materials and resources:

- Graphing paper
- Stripped copper wire
- Coated wire with alligator clips
- Graphite spray
- Nail
- A small wooden or plastic dowel or popsicle stick
- 9-volt battery
- 9-volt battery clip
- Transparent tape
- Glass of water
- Volt meter (or flashlight bulb or LED)

Class 1: Research

Teacher presents how fuel cells work and present the functionality of different fuel cells.
Students conduct mini-research on fuel cell applications.

Class 2: Students Create Fuel Cell

Students follow teacher presentation (movie, ppt, handout) and create fuel cell. Refer to Figure 1: Fuel Cell Picture.
Students test fuel cell and record data.

Fuel Cell Procedure

1. Coil two bare copper wires (coil approximately 1-2 inches in length).
Refer to Figure1. Use the nail to coil wire.

2. Spray wire with graphite to fully coat. Refer to Figure 3: Graphite Spray Coils.
3. Connect 9 volt battery clip to the two coils.
Use alligator clips. Refer to Figure 2: Fuel Cell Picture 2.
4. Connect 9 volt battery for approximately 5 minutes.
5. Disconnect battery and immediately connect multi-meter to coils and test voltage. Expect 0.5-1 volts.

Class 3: Students Design and Conduct Experiment to Improve Fuel Cell

Students design experiment and perform experiment after gaining teacher approval.
Students record data and begin report.

Class 4: Report and Presentations

Students finish lab reports.
Students present findings to class.

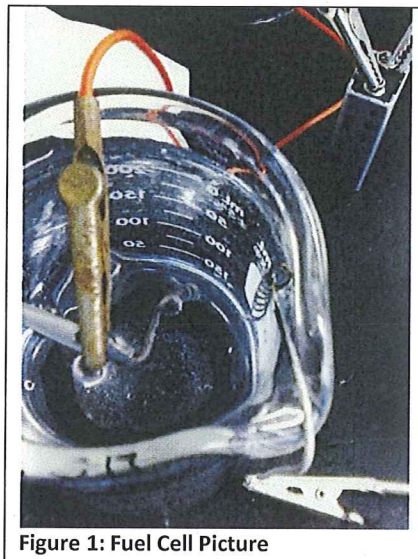

Figure 1: Fuel Cell Picture

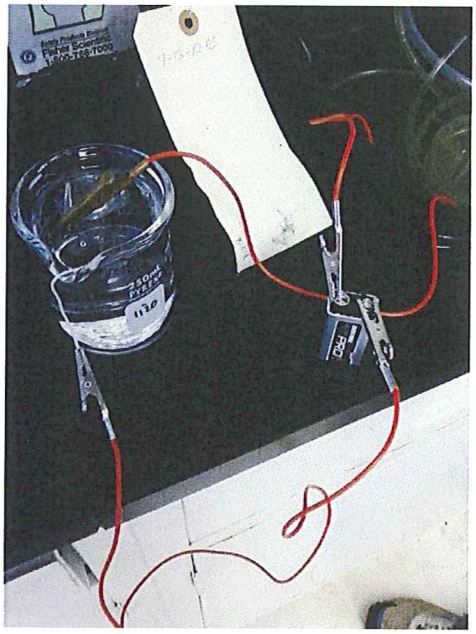

Figure 2: Fuel Cell Picture 2

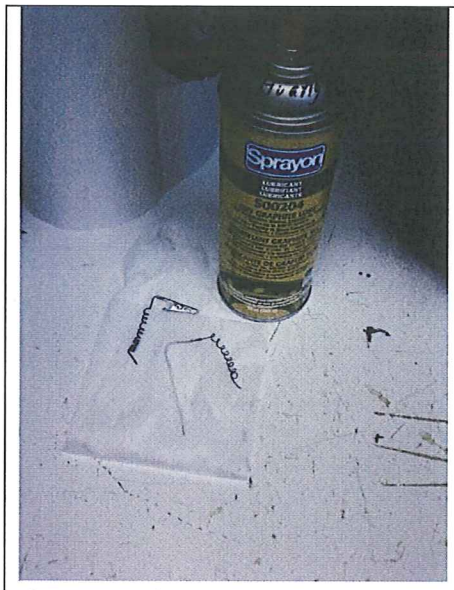

Figure 3: Graphite Spray Coils