

Free Air Quality Teacher's Workshop

Grades 3-12
Friday, March 26, 2004
8:30 a.m. - 3:30 p.m.
Hamilton County
Department of Environmental Services

**Free
Air Quality
Curriculum!**

Attendees will learn about air quality and their health, transportation, economic and social issues; then visit an air quality lab to learn about local air quality monitoring and more about pollen and mold.

Workshop includes breakfast, lunch, grade-level appropriate air quality curriculum, classroom resource, and a \$70 stipend. To find out more, or to register, contact Lynn White or visit our website at www.hcdoes.org. A \$15 deposit is required at registration and will be refunded at the workshop.

In This Issue

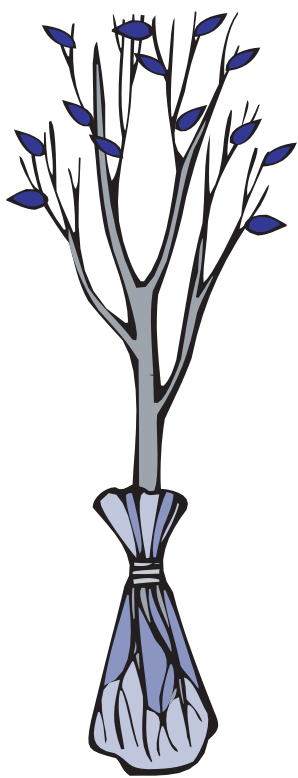
Fuel Cell Technology

Lesson Plans

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Tree Seedling Offer



Register for Free Tree Seedlings

Register your school to receive 25 free tree seedlings to plant on school grounds or for use in community planting projects. Please visit www.hcdoes.org for more information and a registration form, or call (513) 946-7737. Trees are also available to various organizations for community planting projects.

Tree varieties includes Ohio Buckeye, Red Maple, Silky Dogwood, and White Pine. Distribution is on a first-registered, first-served basis. Registration forms are due April 1, 2004. You will receive confirmation of your participation.

ALL seedlings must be picked up during business hours at Funke's Greenhouse, near Spring Grove Cemetery in Cincinnati on Earthday, Thursday, April 22, 2004, during the store's operating hours. The confirmation letter is needed to claim trees on the day of the event.

The Air Quality Management Division, Solid Waste Management District, and the Soil and Water Conservation District of Hamilton County are partnering with Funke's Greenhouse, Inc. to provide up to 2,250 free tree seedlings.

Grant Gives 20 Local School Buses Clean Exhaust Technology

The Hamilton County Department of Environmental Services' (HCDOES), Air Quality Management Division (AQMD), applied for and won a \$95,000 grant from the United States Environmental Protection Agency (USEPA) to retrofit 20 school buses with clean exhaust technology and to fuel 74 buses with biodiesel, a cleaner-burning alternative fuel.

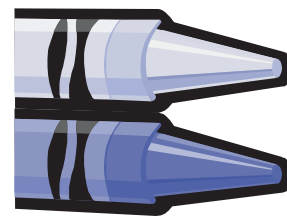


The overall objectives for this grant are six-fold:

- To reduce schoolchildren's exposure to diesel exhaust emissions created by diesel powered school buses.
- To retrofit 20 school buses with oxidation catalysts operating in the urban Cincinnati area, including two environmental justice areas.
- To showcase the school bus retrofit program to the public and other school districts.
- To incorporate an anti-idling policy for the entire fleet of school buses operating under contract with the Cincinnati Public School system encompassing 300 school buses, 120 mini buses, and 110 Metro buses.
- To demonstrate the viability of using biodiesel (B20) as an alternative clean burning fuel in school buses with no trade-offs in performance or maintenance.
- To demonstrate to industrial representatives that school bus retrofit programs are viable options for Supplemental Environmental Projects (SEP) funds from enforcement settlements.

To learn more about this grant and other issues relating to clean technologies for school buses, please visit www.hcdoes.org/airquality/vehicles/grant.htm.

Create A Masterpiece for the 2005 Do Your Share For Cleaner Air Calendar!



The *Do Your Share For Cleaner Air* calendar contest, sponsored by the Regional Ozone Coalition, provides an outlet for student artwork in grades K-12.

One winner from each grade is selected and featured. Entries can either feature the "Do Your Share..." slogan or depict a tip for cleaning the air. To receive a copy of the 2004 Calendar and/or contest guidelines for the 2005 calendar, please contact Summer Jones at (513) 621-6300 or visit www.hcdoes.org.

Air Facts

More Americans die as a result of automotive air pollution than are killed on American highways.

63% of all car trips in the U.S. are 5 miles or less, which could be walked, biked, or combined.

The U.S. uses about half of the world's gasoline supply.

Local Air Quality Resources

Crystal Clear Science, run by former science teacher Michelle White, is a one-woman science show that can come to your school. Ms. White, the founder and presenter, will perform her "Do Your Share for Our Amazing Air" assembly, which teaches students about the properties of air, including air pressure, Bernoulli's principle, Boyle's Law, effect of temperature on air and what students can do to help clean the air. The first twenty of these great assemblies scheduled will be subsidized by the Regional Ozone Coalition (ROC) and are available for \$112.50, regularly \$225. To find out more or to schedule an assembly, contact Michelle White at (513) 741-7174 or at crystalclear@fuse.net



Need More Information?

If you would like to receive The School Breeze by email, please email lynn.white@hamilton-co.org, with the subject box stating "add to The School Breeze list."

For Free Outreach or Resources, contact Lynn White at 513-946-7754 or lynn.white@hamilton-co.org. Visit our website: www.hcdoes.org.

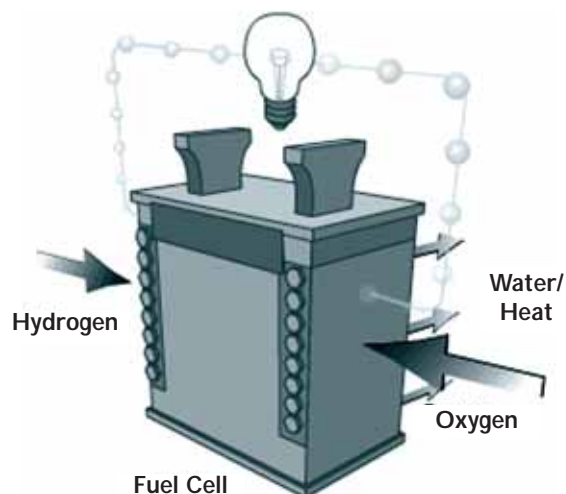
The Workings of A Fuel Cell

Fuel Cells

Fuel cells are not a new technology. They were invented in 1839 by a Welshman, Sir William Grove. The fuel cell did not gain in popularity partially due to the success of the internal combustion motor. A fuel cell revival occurred during the 1960s in the Gemini Space Program. Commercial application was cost prohibitive until improvements took place in the 1990s, reducing costs and increasing power densities.

How Does a Fuel Cell Work?

The fuel cell does not generate energy through burning; it works on the basic principle that when an element is oxidized (chemically combined with oxygen), it releases energy. The fuel cell, an electrochemical device, is twice as efficient at producing energy than through combustion. In principle, a fuel cell operates like a battery. It consists of two electrodes sandwiched around an electrolyte. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water and heat.



Environment Impacts

There are little or no direct harmful emissions from fuel cells. However, the hydrogen must first be produced, usually from several hydrocarbon fuels (natural gas, methane, methanol, gasoline, etc.) through a reformation process. This produces emissions of carbon dioxide, nitrous oxides, sulfur oxides and other pollutants, though at lower levels than burning fossil fuels for energy. If a hydrogen spill occurred, it would evaporate instantly, because hydrogen is lighter than air, leaving only water behind. This a dramatic departure from the stories of oil spills such as the Exxon Valdez in 1989.

The Future

The basic workings of a fuel cell may seem simple, but building efficient, inexpensive, reliable fuel cells is far more complex. This is why there are only a few prototypes in use. However, it has been estimated that by 2010, hydrogen fuel cells will be available for the average consumer to purchase. The main difficulty is setting up a distribution network for hydrogen. No one will buy a fuel cell car unless they can fuel it and companies are unwilling to create a distribution network unless people buy fuel cell cars. This is a "chicken and the egg" style dilemma and is why the first available fuel cell vehicles will be used as fleet vehicles.

Anode reaction: $2H_2 \Rightarrow 4H^+ + 4e^-$

Cathode Reaction: $O_2 + 4H^+ + 4e^- \Rightarrow 2H_2O$

Overall Cell Reaction: $2H_2 + O_2 \Rightarrow 2H_2O$

Fuel Cell Lesson Plans

In the fuel cell, hydrogen and oxygen are supplied to the fuel cell stack, and combine to produce free electrons. These electrons create the electrical energy that travels from the anode side of the fuel cell, through an electrical circuit, and returns to the cathode of the fuel cell. Electrolysis is the reverse of a fuel cell. The battery supplies the electrons and energizes the water. The electrical energy causes the chemical composition of the water (H_2O) to decompose into individual hydrogen and oxygen molecules.

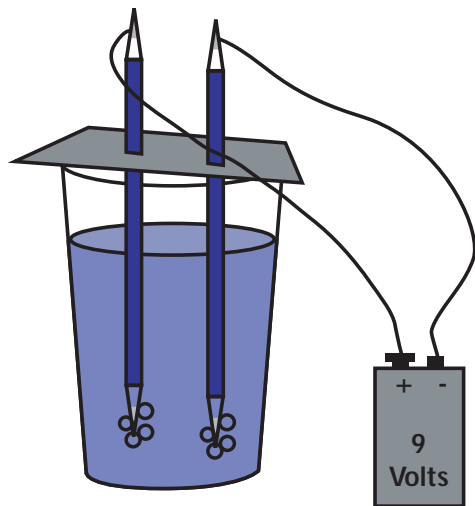
Although chemically, fuel cells and electrolysis are the reverse, the electrochemical process and the transfer of electrons flow in a similar manner between the anodes and cathodes. Electrolysis uses energy to divide water into hydrogen and oxygen, whereas a fuel cell combines hydrogen and water to produce electrical energy.

Materials

- battery or solar panel with a voltage greater than 1.5 volts - (9 volt batteries work well)
- two pieces of electrical wire, a foot long in length
- two number 2 pencils, sharpened on both ends
- jar of tap water
- small piece of cardboard
- electrical or masking tape

Procedure

1. Fill the jar with warm water.
2. Attach wires to the electrodes on the battery and attach the other ends each to the tip of one pencil. Make good contact with the pencil's graphite and secure the wires with tape.
3. Punch small holes in the cardboard and push the pencils through the holes.
4. Place the exposed tips of the pencils in the water, so that the tips are fully submerged, but are not touching the bottom, Adjust the cardboard to hold the pencils.
5. Wait for a minute or so: Small bubbles will form on the tips of the pencils. Hydrogen bubbles will form on one tip (associated with the negative battery terminal - the cathode) and oxygen from the other.



Variations - Electroplating

Add salt to the jar of water to create an electrolyte and attach a penny to the positive (cathode) wire and a nickel to the negative (anode) wire, in place of the pencils. The electrical energy will flow from the anode to the cathode and the ions in the electrolyte will carry the nickel metal particles to the penny. The penny should take on a silver appearance. This is electroplating. If this is not happening move the coins slightly closer together. You will also see a discoloration of the water.

Free Stuff

For Students

K-2 *Friends for Clean Air* Coloring Book

New 3-6 *Clean Air Kids* Activity Book - 16 pages of fun games, activities, and experiments

3-6 "Kids Cloud Express" Activity Sheet

For Teachers

New *All About Air* a comprehensive Book about air quality

The Breeze Quarterly Newsletter for businesses and the community

Living with Allergies Brochure

Transportation and Air Quality Booklets

2004 *Do Your Share For Cleaner Air* Calendar and Contest Rules for 2005

Please visit www.hcdoes.org for more information.

Classroom Programs

Free classroom programs are available for your students. Topics include health, plants, global warming and alternative fueled vehicles. A full list and descriptions are at www.hcdoes.org

Web Stuff

Asthma Coloring Book - From Advocate Health (please note the spelling "coloreng." in the web address). www.advocate-health.com/dl/system/services/asthma/coloreng.pdf

Dr. E's Energy Lab - this site for students has information and activities on energy efficiency, alternative fuels, and solar and geothermal energy. www.eere.energy.gov/kids/index.html

Alternative Fuels - This huge energy site has lots to offer both students and teachers, with background information, lessons, activities, games, and stories, and includes a student's guide to alternative fuel vehicles. www.energyquest.ca.gov/transportation/fuelcells.html

Fuel Cells - Teacher information and lessons relating to Fuel Cells from the General Motors Company. www.gm.com/company/gmability/edu_k-12/teachers/fuel-cells.html

Lesson Plan