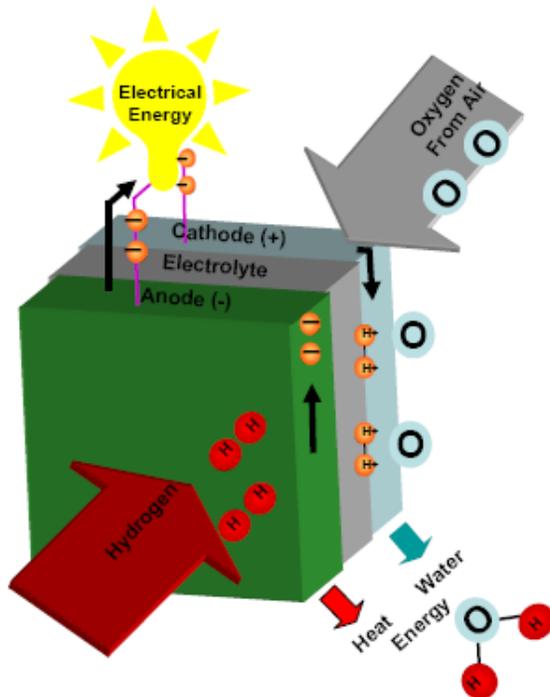
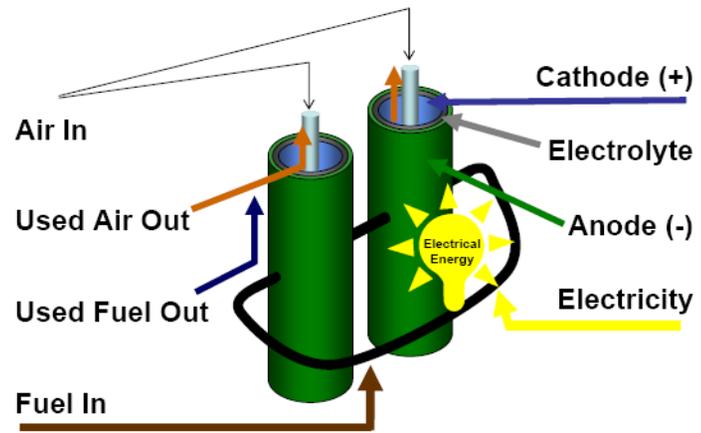


# HYDROGEN and Fantastic Fuel Cells!



Proton Exchange Membrane Fuel Cell - PEMFC



Solid Oxide Fuel Cell - SOFC

# **Lesson Four: Introduction to Fantastic Fuel Cells!**

**Key Concept:** The importance of this lesson is to give an introduction to what a fuel cell is and how it works and what the benefits are.

## **Activities:**

Watch a video of how a Proton Exchange Membrane Fuel Cell (PEMFC) works and make a Solid Oxide Fuel Cell (SOFC) Tube

## **Important words:**

Fuel Cell          Alternative Energy

# Review of some terms:

**Electric Charge**: The charge obtained by an object as it gains or loses electrons.

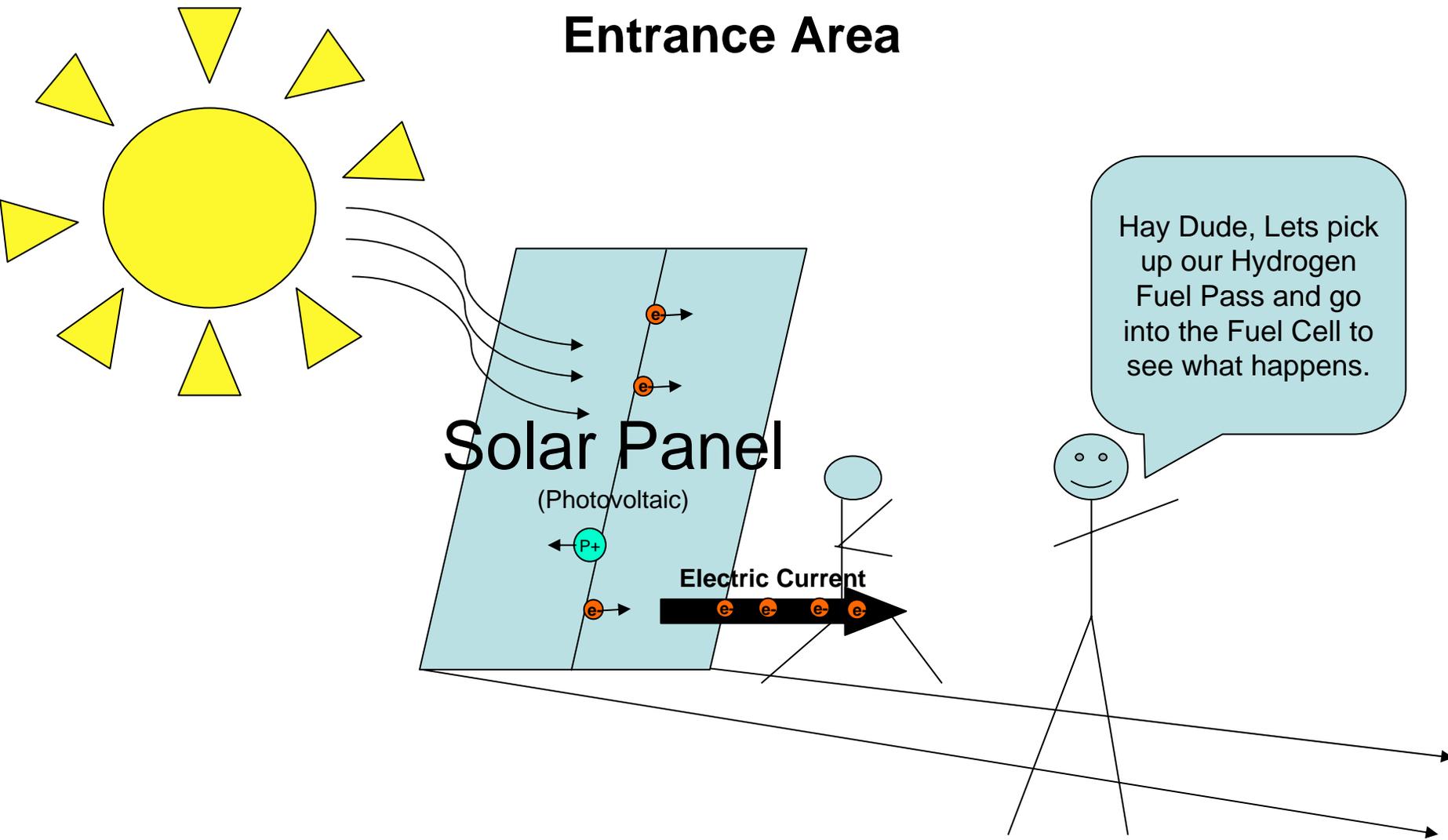
**Electric Circuit**: The path along which electrons flow.

**Electric Current**: The flow of electrons from a negatively charged object to a positively charged object.

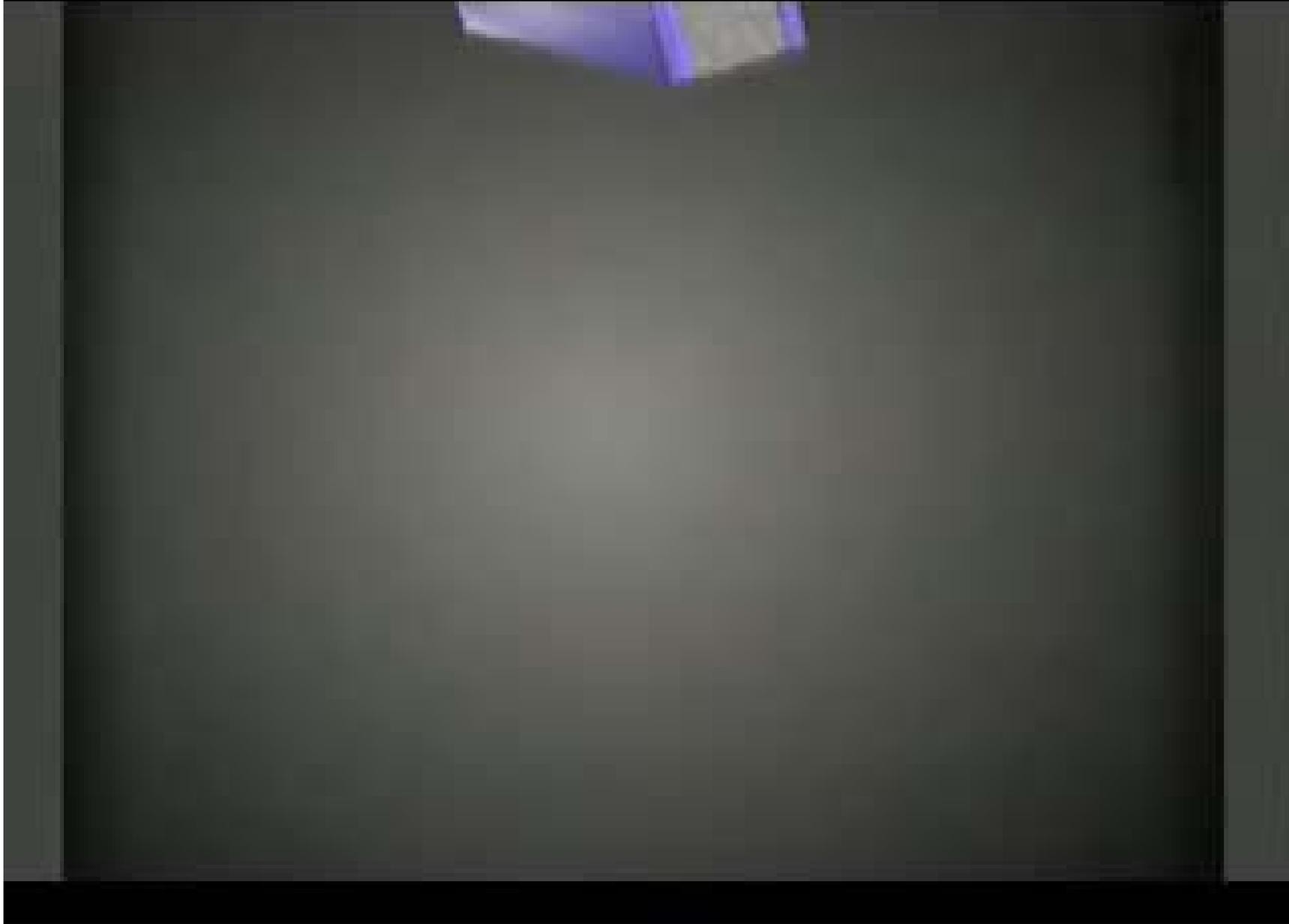
**Electric Force**: The attraction or repulsion of objects due to their electric charges.

# Fantasy Fuel Cell

## Entrance Area



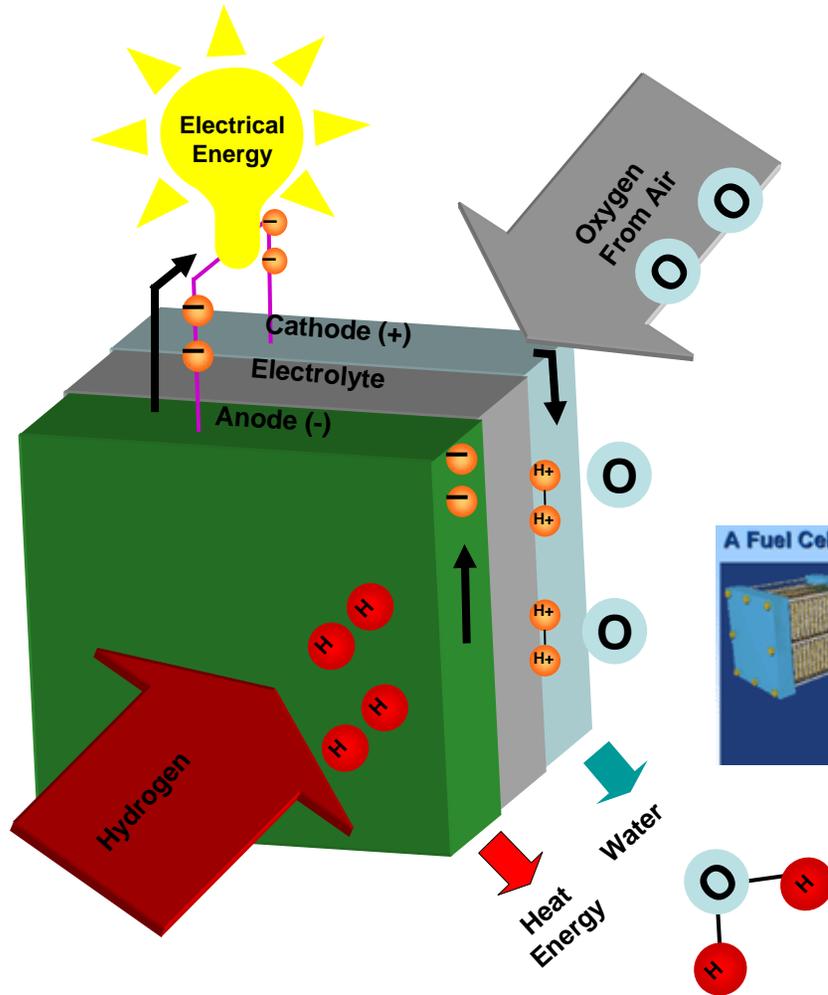
Solar energy makes (produces) electricity used to .....break up water (H<sub>2</sub>O) into H and O...



# Fantastic Fuel Cell

**The objective of a fantastic fuel cell to promote an "Alternative Energy for an Alternative Generation". - Teach kids that gas and other petroleum fuel components are being tested to be consumed to make the environment cleaner, more secure, ...let them know there are still a lot of problems and they are needed to help solve them...**

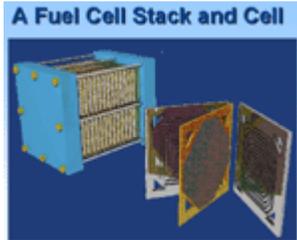
# A Fantastic Fuel Cell



(Load)  
Musical Instruments  
Buildings, Car, Home  
Scooter, Light Bulb



Ballard Airgen portable fuel cell power generators



Proton Exchange Membrane Fuel Cell - PEMFC



## **Some Questions:**

**What is the charge obtained by an object as it gains or loses electrons?**

**What is the electric circuit?**

**What do you call the flow of electrons from a negatively charged object to a positively charged object?**

**What is the electric force?**

**What's important about a fuel cell?**

## Lets see if you know...

How to explain that by decomposing  $\text{H}_2\text{O}$  you can get Hydrogen and Oxygen.

What does exothermic mean?

What does endothermic mean?

**“Hydrogen safety concerns are not cause for alarm; they simply are different than those we are accustomed to with gasoline or natural gas.”**

**-Air Products and Chemicals, Inc.**



**The Spallino family have been test-driving a prototype of a fuel-cell car that runs on hydrogen. Jon Spallino says there's no sacrifice in handling, acceleration, comfort or convenience. The Honda FCX cruises up to 80 miles per hour, when traffic permits. <http://www.npr.org/templates/story/story.php?storyId=5030050&ft=1&f=1025>**



**The first combined hydrogen and gasoline station in North America is located in Washington D.C. and is a joint project with Shell Hydrogen and General Motors. [http://www.shell.com/home/Framework?siteId=hydrogen-en&FC2=/hydrogen-en/html/iwgen/leftnavs/zzz\\_lhn5\\_4\\_0.html&FC3=/hydrogen-en/html/iwgen/news\\_and\\_library/editorial\\_photos/editorial\\_photos\\_0309.html](http://www.shell.com/home/Framework?siteId=hydrogen-en&FC2=/hydrogen-en/html/iwgen/leftnavs/zzz_lhn5_4_0.html&FC3=/hydrogen-en/html/iwgen/news_and_library/editorial_photos/editorial_photos_0309.html)**

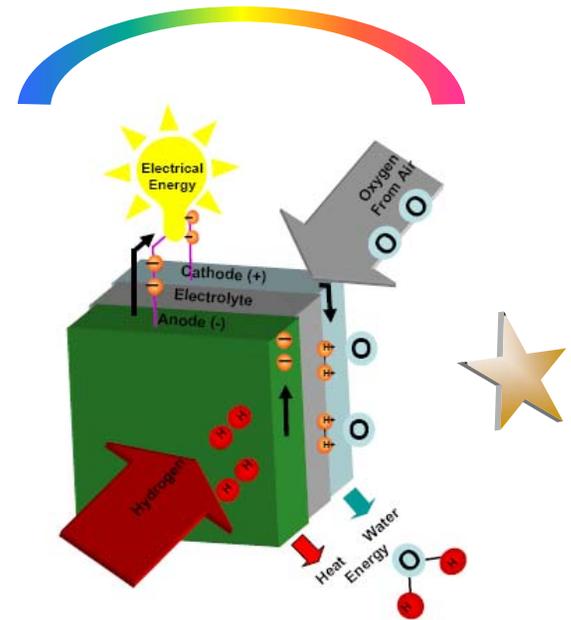
**GM Corp. is launching “Project Driveway” the world’s largest next-generation fuel cell vehicle fleet. More than 100 Chevrolet Equinox Fuel Cell vehicles will be placed with customers in three coastal U.S. markets: New York, Washington, D.C., and Los Angeles in the fall of 2007. USFCC, Weekly Currents, 9/22/2006**

CERTIFICATE OF  
*Participation*  
PRESENTED TO

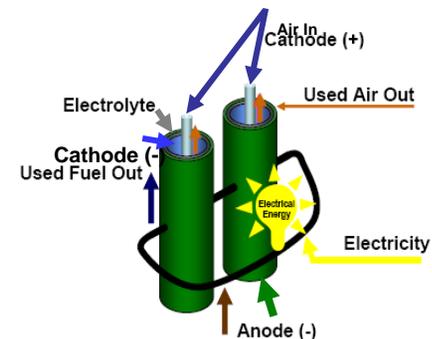
Future Fuel Cell Scientist of America

For Completing Lesson Four:  
Introduction to Fantastic Fuel Cells

Mentor: \_\_\_\_\_



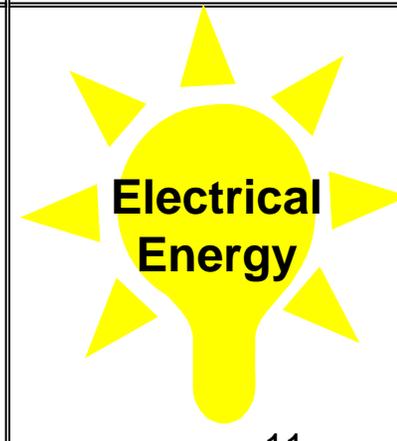
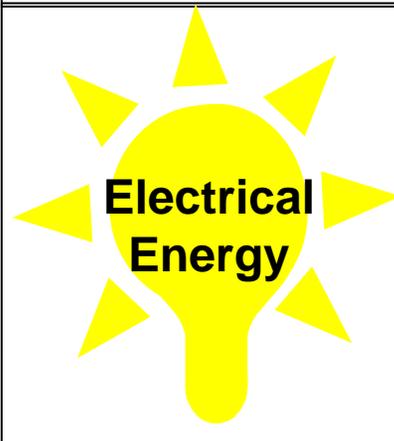
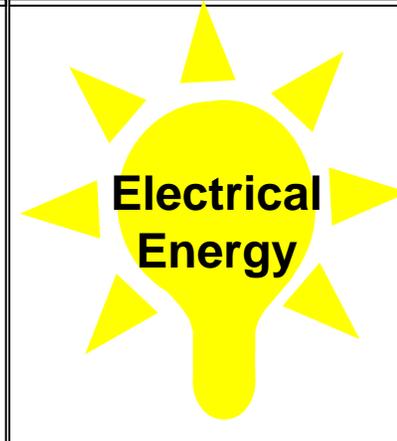
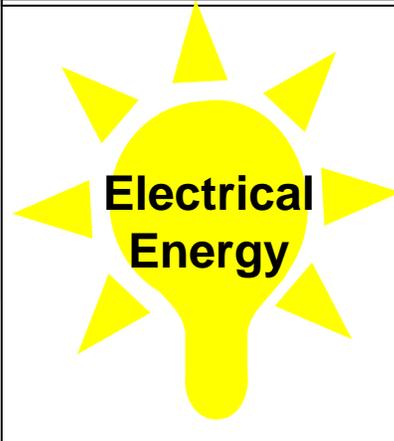
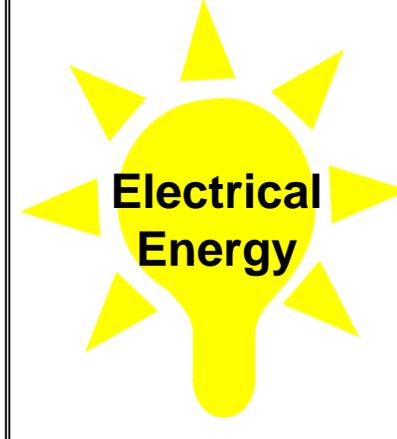
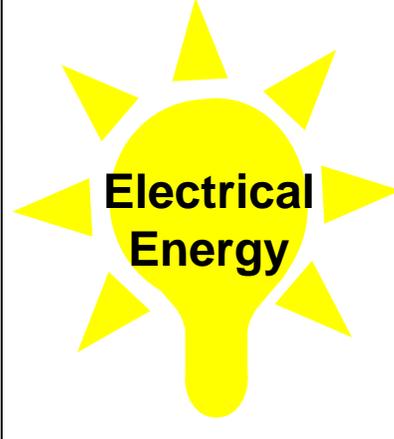
Proton Exchange Membrane Fuel Cell - PEMFC



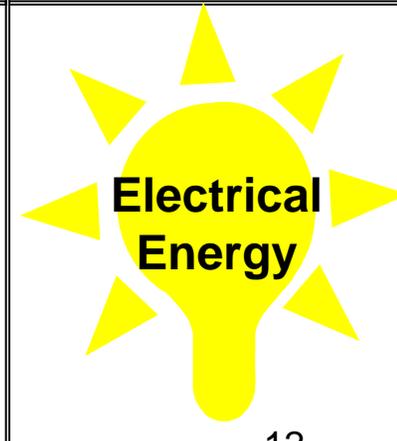
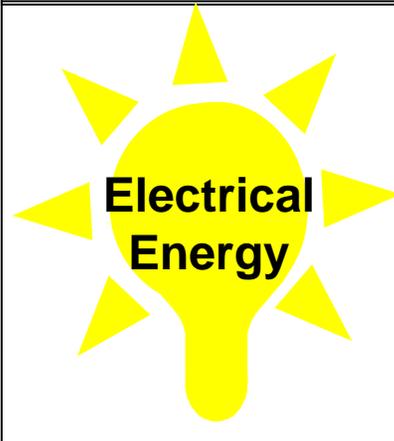
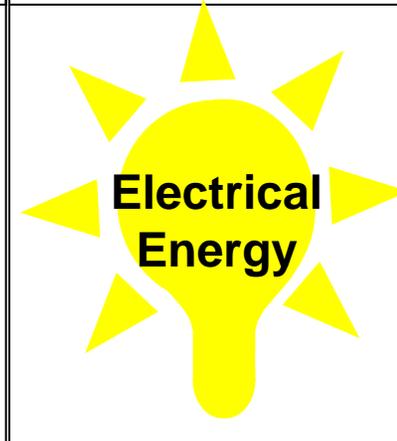
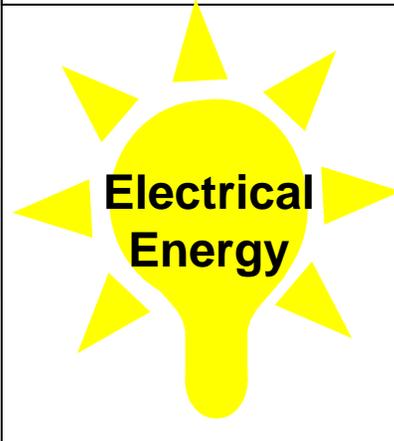
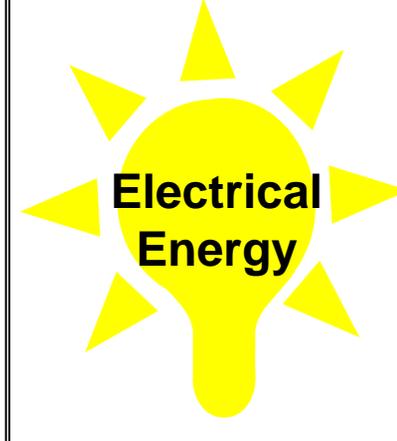
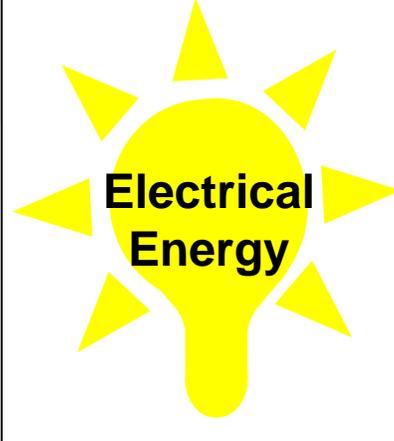
Fuel In  
Solid Oxide Fuel Cell - SOFC



<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-
<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>
<b>Cathode (+)</b>	<b>Cathode (+)</b>	<b>Cathode (+)</b>
<b>Anode (-)</b>	<b>Anode (-)</b>	<b>Anode (-)</b>
<b>Air Tube</b>	<b>Air Tube</b>	<b>Air Tube</b>
<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>
<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-
<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>
<b>Cathode (+)</b>	<b>Cathode (+)</b>	<b>Cathode (+)</b>
<b>Anode (-)</b>	<b>Anode (-)</b>	<b>Anode (-)</b>
<b>Air Tube</b>	<b>Air Tube</b>	<b>Air Tube</b>
<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>
<b>Fuel in</b>	<b>Fuel in</b>	<b>Fuel in</b>



<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-
<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>
<b>Cathode (+)</b>	<b>Cathode (+)</b>	<b>Cathode (+)</b>
<b>Anode (-)</b>	<b>Anode (-)</b>	<b>Anode (-)</b>
<b>Air Tube</b>	<b>Air Tube</b>	<b>Air Tube</b>
<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>
<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-	<b>Electric Current</b> e- e- e- e- e- e-
<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>	<b>Electric Circuit (Pipeline)</b>
<b>Cathode (+)</b>	<b>Cathode (+)</b>	<b>Cathode (+)</b>
<b>Anode (-)</b>	<b>Anode (-)</b>	<b>Anode (-)</b>
<b>Air Tube</b>	<b>Air Tube</b>	<b>Air Tube</b>
<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>	<b>Electrolyte Membrane</b>
<b>Fuel in</b>	<b>Fuel in</b>	<b>Fuel in</b>



# End of Lesson Four