

Energy Harvesting — Hydrogen Fuel Cell

Try this! (1-2 minutes)

Hook up the solar panel to the fuel cell to perform electrolysis, which is where you are generating hydrogen and oxygen from water.

What's going on?

1. Hydrogen is a clean renewable energy carrier which can be used as a fuel in vehicles or to create electricity. When hydrogen is used it only produces water and heat.
2. In order to get pure hydrogen we need to remove it from a compound.
3. What are compounds? What are some examples of compounds?
A chemical compound is a pure chemical substance consisting of two or more different chemical elements that can be separated into simpler substances by chemical reactions. E.g. iron sulfide
4. Electrolysis provides a way of splitting a water molecule into its constituent atoms oxygen and hydrogen.



Hydrogen Fuel Cell

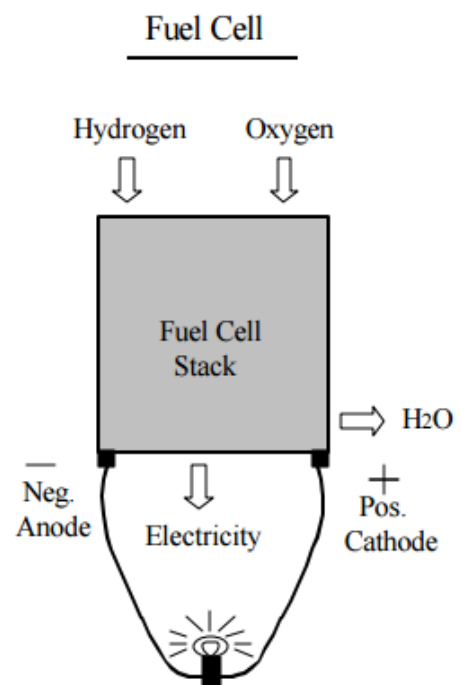
Now try this! (5 minutes)

Disconnect the solar panel and connect the motor. What is happening? How does the car move if there is no power from the solar panel or the battery?

What's going on?

Hydrogen fuel cells are devices that generate electricity using a process that transforms chemical energy from hydrogen into electrical energy.

- In a fuel cell, hydrogen atoms are split into negatively charged electrons and positively charged protons. The electrons are forced to travel through a circuit, which creates an electrical current.
- Once the electrons have travelled through the circuit they combine with the hydrogen protons and oxygen molecules to produce water (H₂O) and heat.
- As hydrogen fuel cells do not give off carbon dioxide or any other pollutants they can be used to help create a zero emission energy system.
- Fuel cells can be used to provide power to buildings, airplanes, vehicles and many different types of electronic equipment. In order to provide the large amounts of electricity needed to power vehicles and other electronic equipment, many fuel cells can be combined together to form a fuel cell stack.
- Hydrogen enters the fuel cell at the electrode known as the anode. The hydrogen atoms are split into electrons (negative charge) and protons (positive charge).
- The positively charged protons are able to pass through the membrane inside the fuel cell. The negatively charged electrons cannot pass



Fuel Cell Diagram

through the membrane so they are forced to travel through a circuit. The movement of electrons through the circuit creates electrical current.

- Oxygen atoms (O) from the air enter the fuel cell at the electrode, known as the cathode. The oxygen joins with the hydrogen protons and electrons to form water molecules.

How is this nano or ASSIST?



One Health

One of the objectives of the ASSIST competition is to investigate energy harvesting. This project harvests energy from Hydrogen.

Learning Objectives

1. Participants will learn about the particle nature of the element Hydrogen and its compounds.
2. Participants will learn about how hydrogen fuel cells can create electricity.
3. Participants will develop an understanding about the chemical reactions involved in hydrogen fuel cells and hydrogen fuelled internal combustion engines

Materials

1. Hydrogen Fuel Cell Car Kit -
http://www.stevespanglerscience.com/fuel-cell-car-science-kit.html?gclid=CjwKEAju5pKtBRCqpfPK5qXatWYSJABi5kTx0Ydi4ZpfQBKzVXULRc1espgbMmszAiTxSYittCZVKhoC98vw_wcB
2. Distilled Water

Notes to the presenter

Before doing this activity, please do the following:

- Order a hydrogen fuel cell, see above
- Buy Distilled water

Related educational resources

- For further research:
 1. Ask students to research real life applications of hydrogen technology (London buses, refuellers)
 2. A model car building challenge with recycled materials
 3. How could your school become more energy efficient?
- <http://londonschoolshydrogenchallenge.co.uk/>

Credits and rights

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