

Community in the Classroom Presentation Plan

Lesson Name Solar Cells

Presenter(s) Erik Garnett and Michael Grass

Grade Level 8

Standards Connection(s) Chemical Reactions

Abstract

With iodine, blackberry juice, and a few simple materials, students will create a working solar cell that mimics the process of photosynthesis. This type of cell is called a Grätzel cell. Grätzel cells are in commercial operation and cost half as much as silicon solar cells.

Vocabulary:

Solar Energy

Solar Cell

Photosynthesis

Grätzel Cell

Nanoporous

Materials:

Glass stirring rod or similar object

Scotch tape

Blackberry or raspberry juice from squeezed berries

Ethanol or isopropanol

Small shallow dishes

Paper towels

Dropper bottle or eyedropper

Washbottle

Distilled water

Soft graphite pencil or graphite stick

Candle or hot plate

Small binder clips (2 per solar cell)

Multimeter

Two alligator clip leads

Specialty materials

2 conductive glass slides

Titanium dioxide paste (nanocrystalline TiO_2 + vinegar + Triton)

Iodide electrolyte solution (I_2 + KI in ethylene glycol)

Classroom Set-up:

GROUPING:

Prior to the lesson, establish that students will work in teams of four.

Each team will need its own table or flat, clear surface area on which to work.

MATERIALS TO BE PROVIDED BY THE SCHOOL SITE:

Paper towels (4 or more per group)

Scotch tape (1 roll per group)

Small, shallow dishes (1 per group)

In order to maximize the instructional time with the students, materials will be pre-arrange on individual trays with a set of materials that each group will need. (There are approximately 32 students in each class. Eight sets of materials would be needed to accommodate groups of 4 students per team.)

We will have 10 sets to accommodate extra students and/or smaller groups.

A large poster outlining the steps in the fabrication of the solar cells will aid in the presentation.



Classroom Visit

1. Personal Introduction:

5 Minutes

We will introduce ourselves with a very basic description of what we do. Because time is limited, we will need to be very brief with this introduction.

Topic Introduction:

5 Minutes

We will discuss how research affects our lives (inventions such as computers, cell phones, etc.)

We will also discuss solar energy and cover key terms/concepts that will be useful for understanding the solar cell experiment:

Solar Energy

Solar Cell vs. Photosynthesis

The eighth grade students will likely be familiar with solar powered devices. Some may have a base understanding for how solar cells work. The students are likely to be familiar with the process of photosynthesis. The groups of students may be asked to describe the process of photosynthesis.

Grätzel Cell

Grätzel cells are working solar cells that mimic the process of photosynthesis.

Nanoporous

Adolescent students will know a little about pores, big and small. We may draw a connection between facial pores and nanopores and may demonstrate how "pores" naturally form by showing that liquid can fit in between marbles or other balls in a tub with liquid.

2. Learning Experience(s):

40 Minutes

Because of limited time, after the introduction and a brief discussion of the parts of the solar cell, students will need to begin making the solar cells. We will briefly emphasize the processes that will occur in the solar cells that they make with an emphasis on the following concepts from the science curriculum:

Chemical reactions and processes:

- reactant atoms and molecules interact to form products with different chemical properties;
- the idea of atoms explains the conservation of matter: In chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same;
- chemical reactions usually liberate heat or absorb heat;

While student groups are making their cells, we will circulate through the classroom to ask questions and emphasize the above concepts in terms of what is happening in the solar cells.

Students will test their solar cells outside and then we will demonstrate lighting up a light bulb using 4 large solar cells connected in series.

3. Wrap-up: Sharing Experiences and Building Connections

5 Minutes

We will discuss how much electricity was generated from the solar cells and how research is needed to improve how efficient and cheap solar cells are so that they can generate enough electricity to power homes, etc.

4. Close:

5 Minutes

Students will wash their solar cells and put back all the chemicals for the next group of students. One group member will be in charge of organizing their tray, another student in charge of cleaning up the desks, a third in charge of cleaning the solar cells, and the last student will throw away any disposable materials that were used.

TOTAL 50 – 60 Minutes

Follow-up – After Presentation

Students and teachers may be interested in the following website which serves as a portal to solar electric energy:

www.solarelectricpower.org

