Bay Area Scientists in Schools Presentation Plan

Lesson Name Energy and Energy Conversion

Presenter(s) Groves Lab

Grade Level 3 **Standards Connection(s)** Energy

Abstract: We'll do a short power point presentation about the different kinds of energy then break into four stations that will have activities to solidify the presentation to the kids. The stations will be: electrical energy, waves, chemical energy, potential and kinetic energy.

Vocabulary/Definitions:

- Energy - the work that a certain force (gravitational, electromagnetic, etc) can do.
- Kinetic energy - the energy that a body possesses as a result of its motion.
- Potential energy - the energy of a particle derived from position, or condition, rather than motion. A raised weight, coiled spring, or charged battery has potential energy.
- Gravity - the natural force of attraction exerted by large objects, such as the Earth, upon objects at or near its surface, tending to draw them toward the larger object.
- Conversion - the act of changing from one use or function to another
- Chemical energy - that part of the energy in a substance that can be released by a chemical reaction.
- Electrons - a fundamental subatomic particle that carries an electric charge.

Materials: Projector, computer, and the station materials.

Classroom Set-up:
We will need a white surface to project a power point presentation. Kids well also need to split up into four groups and rotate between four stations.

Classroom Visit

1. Personal Introduction: **3 Minutes**
This will be variable depending on who is presenting. But the overall them is we are Berkeley Graduate students studying Membrane Biophysics in the College of Chemistry.

Topic Introduction: **15 Minutes**

- This will be the powerpoint presentation complete with pictures for examples. We will also have a demonstration with a balloon and static electricity on hair to break the monotony.

2. Learning Experience(s): **24 Minutes**

Stations include:

1) **Electrical:** batteries lighting a light bulb. Here potential energy is stored in the battery and released via a chemical reaction to power a light bulb which releases heat and light energy. Electrons flow through the wire to the lightbulb and produce energy in the form of light waves. We will model this system with tennis balls representing the electrons and kids representing the wires and bulb.

   Kids will pass around tennis balls which will represent electrons then use batteries to power a light bulb.

2) **Waves:** this is an important but abstract concept. Here the potential energy in your body (sugars and fats) are released by a chemical reaction in your body and converted into kinetic energy as you pluck the strings of a guitar. This kinetic energy is then transferred into sound that you can hear by vibration of the guitar strings. To visualize the vibration of the guitar string we will have the kids oscillate a rope or slinky.

   Energy in the form of waves: we will have a guitar and some oscillating rope for easy visualization.

3) **Chemical energy:** this will be a vinegar and baking soda reaction. Pour the vinegar over some baking soda and the chemical components will release energy in form of bubbling and fizzing. We will also investigate the possibility of doing a chemiluminescence reaction; this will probably need to be done in front of the class during the closing section.

   Chemical energy: pouring vinegar over baking soda makes it bubble.

4) **Potential and kinetic:** this will focus on the simplest manifestation of energy conversion. We will have a car on board: when the board is flat the car won't move but when you introduce a grade (elevate one side of the board), you give the car potential energy. When you release the car the potential energy is converted into kinetic energy and the car will move down the grade and collide into some blocks and legos. Also, a rubber band powered car will show that potential energy can be stored in a twisted rubber band. The teacher can run this station.

   Conversions from potential to kinetic energy: we'll have matchbox cars on a board and a rubberband operated car.

3. Wrap-up: Sharing Experiences and Building Connections **5 Minutes**

Here we will talk about how all the energies are related (i.e. the batteries are a form of storing chemical energy, which can be released via a chemical reaction and converted into energy in the form

of waves like a radio or kinetic energy like a remote control car). Perhaps we will also have a chemiluminescence demonstration.

4. Close: **3 Minutes**

How can kids learn more? Thanks and good-bye! Clean-up.

TOTAL 50 – 60 Minutes

Follow-up – After Presentation

Suggest students write a letter explaining "How we learned about energy and energy conservation?"

What is Energy? (*Colorado State University – Physics Department)*
http://littleshop.physics.colostate.edu/activities/atmos1/EnergyToys.pdf

Reading Connections:

- Young Discoverers Energy and Power: Environmental Facts and Experiments by Sally Morgan -- Explains what energy is and how we use it. Covers our use of both renewable and nonrenewable resources, as well as various forms of alternative energy. http://www.amazon.com/Young-Discoverers-Energy-Sally-Morgan/dp/1856973816

- Energy Makes Things Happen by Kimberly Brubaker Bradley -- Simple language and humorous illustrations show that energy comes originally from the Sun and transfers from one thing to another. http://www.amazon.com/Energy-Things-Lets-Read-Find-Out-Science/dp/0060289082

Stretch Your Potential

(from *Children's Museum of Houston*)

Video at: http://www.cmhoustonblog.org/2010/08/16/stretch-your-potential/

To summarize the First Law of Thermodynamics, energy can neither be created nor destroyed, only changed (also known as the Law of Conservation of Energy). Basically, it means you can't have energy magically appear in a system; it has to come from somewhere. Here's a little experiment that helps demonstrate this idea:

What to Do:

1. Get a bamboo skewer (available at most supermarkets) and cut off the pointed end. You can also use a 1/8" wooden dowel cut to about 12 inches.
2. Duct tape a rubber band to one end of the skewer. I do suggest duct tape, as masking and scotch tape won't hold as well
3. Cut a drinking straw in half.
4. Thread the other end of the skewer (the one without the rubber band) through one piece of the straw
5. Duct tape the other end of the rubber band to the straw
6. Place the un-taped end of the skewer onto a table, pull the straw down, and then let go. It should go flying!

CAUTION: *Do not point it at anyone including yourself when you let go.*

What's Happening?

A stretched rubber band has potential energy. Potential energy means energy that is stored until ready to be transformed into a different type of energy. In this case, the stretched rubber band wants to return to its original shape, so that is what creates the potential energy.

When you let go of the toy, the rubber band snaps back, transforming the potential energy into kinetic energy (energy in motion). That kinetic energy generates the force needed to lift the toy off the table. The more you stretch the rubber band, the more potential energy is available to transform into kinetic energy.

Now some people may say that the potential energy didn't come from anything, so wasn't it created? Nope, sorry! That potential energy came from the kinetic energy you used to stretch the rubber band in the first place. And that energy came from the chemical energy stored in the food you ate. And so forth and so on…