Electronics Investigation
Electrical and Computer Engineering

Objective
This lesson teaches students where electricity comes from, and how electrical engineers manipulate the flow of electrons for computation, movement, music, etc.

Standards and Objectives
- 7th Grade Standard 1, Objective 3
- 8th Grade Standard 4, Objective 1
- Chemistry Standard 2, Objective 2
- Physics Standard 3, Objective 2

Learning Outcomes
Students will learn:
1. The parts of an atom
2. The definition of electricity
3. How engineers harness electricity
4. The following terms: current, voltage, resistance, and capacitance; as well as examples for each (using the flow of water to illustrate these concepts)
5. What these components look like inside electronics
6. That math and science always work together.

Essential Questions
1. How do engineers use electricity to make electronics work?
2. Where does electricity come from?
3. What is an electrical engineer?
4. What are some examples of electrical engineering?
5. What is the difference between voltage and current?
6. What are other ways to get energy? (see Green Unit)

Time Required (Itemized)
1. Power Point presentation (20 minutes)
2. In class investigation activity (30-45 minutes)

Assessments
See attached worksheets

Materials
1. Old electronics (can be purchased very inexpensively at thrift stores or students can be assigned to bring 1 or 2 electronic devices from home that do not function—they will be unusable at the end of the investigation).

Lesson Description

The Power Point presentation entitle "Electricity and Electrical Engineering" introduces current, voltage, capacitance, resistance, etc. The first slide reviews the parts of an atom. Ask the students to name the parts and the charge associated with each (proton—positive, neutron—neutral, electron—negative). Electricity is the flow of electrons. What charge would electricity have? (Negative.) To demonstrate the amount of energy in one atom, the second slide asks what happens when you split the nucleus of a single atom. There is obviously a great deal of energy in one single atom.

The presentation compares the flow of electricity to the flow of water. The first, current, shows a picture of the Colorado river. Notice how the river is flowing steadily. What would happen if you choked off the river suddenly? (It would back up—like a traffic jam.) Voltage is the amount of energy in electricity. We compare it to Bridal Veil Falls. What if the waterfall were just a little ripple? What if it were a taller waterfall? (This is an example of potential energy, so the higher the waterfall, the higher the voltage (more energy) would be. Resistance is another way to manipulate the flow of electricity. In the example of the "Goosenecks" of the San Juan River, we show about two miles of river that has been collapsed into about ½ mile. It would take the current just as long to travel 2 straight miles as it would to travel ½ mile through the "Goosenecks." A capacitor is how we store electricity. This shows a picture of the Glen Canyon Dam (Lake Powell). Have you ever heard the sound when the power goes off (very much like Star Wars, when Obi Wan Kenobi turns off the power—you hear that funny sound). That is the sound of the electrons leaving the capacitor. Capacitors are just like batteries—they store electricity. An inductor is similar to a water wheel, but instead of the water wheel being moved by the water, the inductor actually pushed the electricity through quicker.

1. A mathematical concept that should be used with this is Ohm's Law (V=IR), where V=voltage, I=current, and R=resistance. This equation can be rearranged algebraically. Students should see that math and science always work together.

With regard to magnets and electricity, they both have a charge. In addition this is how a power plant works. There is a room with a large coil along the walls, and a large magnet in the center of the room. Coal is pulverized and burned to generate steam, which spins the magnet, which shoots off electrons, which we use to provide power to homes, schools, etc. The next slide shows the Hunter Power Plant in Castle Dale, Utah.

The next slide introduces us to Electrical Engineering and products of technology research in the field: computers, circuit boards, cell phones, televisions, robots, digital music, power lines, CAT scan machines, and satellites. These are only examples, and there are thousands of products that have been produced by Electrical Engineers.

After the presentation, have the students break into groups (2-4—larger groups do not work well) and have them begin to identify capacitors, resistors, etc. as they dismantle their electronic devices.

1. See worksheet for a guided activity.