Master Teacher: Tamar Burris
Lesson Title: Let it Shine
Grade Level: 5
Time Allotment: 1 class period (1 hour)

Overview: In this lesson students will explore the concept of electricity. They will first participate in a short discussion on electricity so that they begin to understand the importance of electricity in our daily lives. Next they will watch a video on electricity to learn about Benjamin Franklin's experiments with electricity and gain an understanding of how electricity works. They will then participate in an interactive Internet activity that will teach them about simple circuits. Finally, students will experiment with making simple circuits on their own and learn about conductors and insulators.

Subject Matter: Science

Learning Objectives:
Students will be able to:
- Identify the necessary components of a simple electrical circuit;
- Identify that copper and tin are good conductors of electricity;
- Identify that rubber is a good insulator; and
- Build a simple electrical circuit that turns on a light bulb

Standards:
The following standards were taken from the State of Montana Office of Public Instruction Web site at http://www.opi.state.mt.us/

State of Montana Science Content Standard 2: Students demonstrate knowledge of properties, forms, changes, and interactions of physical and chemical systems.
Benchmark – *Define energy and compare and contrast the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves.*
Science Content Standard 6: Students understand historical developments in science and technology.
Benchmark – *Identify major milestones in science that have impacted science, technology, and society.*

Media Components:

Web Site
BBC Revisewise Science
http://www.bbc.co.uk/schools/revisewise/science/physical/11_act.shtml
Hosted by the BBC, this Web site is an interactive site for ages 4-11 with activities covering multiple subjects. In this particular activity, students are asked to try building different circuits in an online activity. By participating in the activity they will learn about closed circuits and their components.

Video
Assignment Discovery: Electricity's Attraction

Materials:

Per Group:
- Strips of tin foil, 2 strips about 12 inches in length per group
- D batteries, 1 per group
- Miniature light bulbs, 1 per group
- Copper wire, 2 pieces about 12 inches in length per group
- Strips of rubber, 2 about 12 inches in length per group

Prep for Teachers:
- Load and cue video to the visual of a drawing of Benjamin Franklin with a kite and a voice saying, "In 1752, Benjamin Franklin launched a kite…"
- Bookmark http://www.bbc.co.uk/schools/revisewise/science/physical/11_act.shtml
- Obtain lesson materials

When using media, provide students with a Focus for Media Interaction, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites, or other multimedia elements.

Introductory Activity:

1. Divide students into groups of 3-5.

2. Write a list of these objects on the board or on an overhead projector:
   - Lamp
   - Toaster
   - Hair dryer
   - Computer
   - Washing machine
   - Television

3. Have students talk among themselves in their groups for a few minutes to determine what all these items have in common. *(They all need electricity to work)*

4. Once students have figured out that all the items need electricity to function, have a short class discussion about electricity. Ask such questions as "What is electricity?" "What do you think life would be like without electricity?" Talk about how integral electricity has become to our everyday lives. Discuss where electricity comes from; tell students that although they plug their appliances into an outlet, electricity in their home is actually produced by a generator that could be miles away and their outlets are just tapping into power lines that originate with the generator. Talk about batteries and how they are another producer of electricity.

Learning Activities:

1. Load and cue video to the visual of a drawing of Benjamin Franklin with a kite and a voice saying, "In 1752, Benjamin Franklin launched a kite…" Tell students that they will be watching a short video on electricity. Set the Focus for Media Interaction: After watching this section of the video I want you to tell me two things: What was Benjamin Franklin's storm warming device made of? How did Benjamin Franklin's storm warning device work? PLAY tape.

2. PAUSE tape with the audio cue of "…designation of positive and negative charge." into sounds of thunder with an image of lightning bolts. Ask students to answer your focus questions. *"*What was Benjamin Franklin's storm warming device made of?" *(Two bells and a neutral pendulum) "*How did Benjamin Franklin's storm warning device work?" *(Benjamin Franklin's bell device was made of two bells, one attached to the ground and one attached to a lightning rod. When a thundercloud approached, the air became electrified and the bell attached to the rod transferred its electric charge through a neutral pendulum to the other bell. When the bells began to ring, Franklin knew a storm was coming.)* Talk about the dangers of the experiments Franklin conducted with electricity. "What could have happened to Franklin*?" (He might have been badly electrocuted)*

3. Before resuming the tape, Set the Focus for Media Interaction: What is electricity*?* What is electric current? What are some good conductors of electricity? What types of materials are not good conductors (insulators)? RESUME playing tape with the audio cue of "An atom's nucleus has a positive" with a visual of a black and white image of a model atom. STOP the tape at an image of the aurora borealis with a voice saying, "…get caught in the earth's magnetic field." Ask students to answer your focus questions. "What is electricity*?" (Electricity is the flow of electrical charge) "*What is electric current?" *(The movement of electrons from negative to positive)* "What are some good conductors of electricity?" *(Copper and other metals)* "What types of materials are not good conductors (insulators)?" *(Clay and rubber)*

4. Tell students that they are going to be participating in an online activity to learn more about electricity and electrical circuits. Keeping students in their groups of 3-5, tell them to move to the computers and log on to: http://www.bbc.co.uk/schools/revisewise/science/physical/11_act.shtml. Set the Focus for Media Interaction: After completing this electricity activity I want you to be able to tell me what a complete circuit needs in order to work *(battery or generator, conductors such as copper wire, and a device such as a light bulb or buzzer)* Also, will a circuit work if there is a break or gap in it? *(No, in order for a circuit to work properly the light bulb or other device has to be attached to conductors that are attached to a power source in a closed circuit)*

5. Give students about 15 minutes or so on their computers to read the "Wise Up" section of the activity and complete the "Now Try This…" activity. Allow fast finishers to go on to take the quiz at the end of the activity while waiting for the rest of the class to finish.

Once everybody has finished the "Now Try This…" ask students to answer your focus questions. "What does a complete circuit needs in order to work?" *(Battery or generator, conductors such as copper wire, and a device such as a light bulb or buzzer)* "Will a circuit work if there is a break or gap in it?" *(No, in order for a circuit to work properly the light bulb or other device has to be attached to conductors that are attached to a power source in a closed circuit)* If enough students have taken the quiz, ask them to share the questions that they got right and talk about some of the questions that the students had trouble with.

Culminating Activity:

1. With students still in their groups, have them return to their group workspace. Tell students that they will be making their own electric circuits, similar to the ones they worked with online.

2. Pass out one light bulb, one battery, and two strips of tin foil to each group. Have the groups examine their batteries to find the negative terminal (marked with -) and the positive terminal (marked with +). Explain that electricity is produced through the chemical reaction of the materials inside the battery and an electric current flows through the negative terminal to the battery's positive terminal.

3. Have students fold a piece of tin foil and attach one end to the negative terminal. Then ask them to fold their second piece of foil and attach one end of this foil to the positive terminal on the battery. "Is this a circuit?" *(No, because it is not connected)*

4. Have students attach the loose ends of the tin foil to the metal bottom section of the light bulb. "What happens?" *(The light bulb lights)* "Why?" *(Because electricity is flowing through the negative terminal on the battery to the light bulb and back to the positive terminal on the battery; the circuit is connected)* "Is tin foil a good conductor of electricity?" *(Yes)* "How do we know?" *(The light bulb is lit)*

5. Have students remove the tin foil from the battery terminals and the light bulb. Pass out the copper wire. Have students try to make a circuit on their own. Walk around the room and observe as the students light their light bulbs. When all groups have successfully made a circuit with the copper wiring ask them if copper is a good conductor. *(Yes)* Have the groups attempt to make a circuit by attaching both wires to just one end (either the positive or negative terminal) of the battery and then attaching the loose ends to the light bulb. "Does the light bulb light?" *(No)* "Why not?" *(This is not a complete circuit)*

6. Pass out the strips of rubber and have students try again to make an electric circuit. "Does the light bulb light?" *(No)* "Why not*?" (Rubber is not a good conductor. Rubber is an insulator.)* Talk about the importance of insulators *(We cover our electric wires with rubber or other insulators to protect us from the electric currents running through the wires; insulators can protect us from lightning)*

7. Collect the materials.

Cross-Curricular Extensions:

Science
Conduct experiments with alternating and direct circuits, switches and resistors; test other materials to determine whether they are good conductors or insulators

Science/Social Studies
Research some of the important inventors that experimented with electricity and how their inventions have changed our world

Math/Science
Design and build simple mechanical machines that use electricity

Geography/Science
Research the many different sources of electricity, where in the world these sources are found, and any controversy surrounding our use of them

Social Studies/Science
Research the 2003 East Coast power outages and how the loss of electricity affected the United States

Community Connections:

- Invite an electrician to the classroom to discuss electricity in our homes

- Take a field trip to a local power plant and teach students about your area's power grid
- Invite a scientist to the classroom to talk about electricity and its uses
- Make posters on ways to save energy and energy safety and post them around the school