NTTI Media-Rich Lesson

NAME
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LESSON TITLE
Light Up Your Life!

GRADE LEVELS
4th

TIME ALLOTMENT
2 classes-1hour each

OVERVIEW
People have always been fascinated by electricity. The natural electricity we see displayed in a lightning bolt fills us with a combination of fear and awe. The shattering sound and the blinding brilliance of a lightning bolt is a form of static electricity. We are also fascinated by human generated electricity, current electricity. How is it we are able to light up a bulb? How can we make the light bulb turn on and off? What is the science behind it all? In this lesson, students will explore current electricity by building open and closed circuits. Students will be able to identify all the parts of a circuit, specifically, the cell, the wire and the light bulb, and explain how each part works to make the bulb come on,. Through the use of technology students will explore a diagram of an atom and be able to explain the relationship between electrons and current electricity. Students will build parallel and series circuits in order to compare and contrast them. This lesson will also provide links to African Americans who have contributed greatly to the advancement of electricity.

SUBJECT MATTER
Physical Science-Current Electricity

LEARNING OBJECTIVES
Students will be able to:

- Demonstrate and explain the difference between open and closed circuits.
- Explain that electromagnetic energy lights up a bulb
- Explain the relationship between atoms and electricity
- Demonstrate and explain the difference between parallel and series circuits

STANDARDS
Georgia's Quality Core Curriculum
Standards: QCC #9
Topic: Energy and Its Transformation: Magnetism and Electricity
Standard: Demonstrates differences between open-closed circuits and parallel-series circuits. Constructs examples of open and closed circuits and parallel and series circuits with differing numbers of batteries and bulbs.

Georgia's Quality Core Curriculum's website
www.glc.k12.ga.us

1. Click QCC Standards and Resources
2. Once your there, put in Grade-4, Subject-Science and Search
3. Go to Physical Science
4. Go to QCC #9 (listed above). This page will also give you a additional lesson plan ideas and web resources

MEDIA COMPONENTS

Video

PBA 30, *Motion, Energy and Force Series,* #104, "Energy"

Internet

www.brainpop.com
Brainpop.com is a website that provides students with short movies in the areas of science, mathematics, health and technology. Brainpop.com offers 2 free movies daily for each computer you have. The movies allow you to pause, skip ahead, and skip back. Teachers may sign up for 2 free weeks of unlimited movies.

http://www.princeton.edu/~mcbrown/display/faces.html

This address will take you to the Faces of Science: African Americans in the Sciences. Here students can learn about Lewis Latimore along with many other contributors.

www.chemheritage.org/EducationalServices/chemach/pop/wlh.html

This site informs students about Lincoln Hawkins. The African American physicist who lengthened the life of rubber used to insulate wires.

http://www.blackpioneers.org/Black%20Pioneers.htm
This site presents students with biographies on African American scientists.

www.glovis.com

Glovis technology is an organization dedicated to infusing the contributions of African American scientists into the educational process. They are a tremendous resource, offering, in-service training, demonstration lessons and materials.

MATERIALS

Per Class

- ✓ 1-2 wire cutters
- ✓ 1 spool of insulated wire
- ✓ (The following numbers are based on a class of 20)
- ✓ 40 light bulbs
- ✓ 40 light bulb holders
- ✓ 20 cells
- ✓ 20 cell holders
- ✓ 20 switches
- ✓ 20 Electricity and Magnetism-Focus for Media Interaction sheets
- ✓ 5 pictures of parallel circuits, 1 per group of 4

Each set of partners receives

- ✓ 1 light bulb
- ✓ 1 cell
- ✓ 1 insulated wire, pre-stripped on both ends

Per Every Two Students

Students work with a partner

Students use materials from introductory activity along with:

Baggie #1 with:

- ✓ 2 cell holders
- ✓ 2 light bulb holders
- ✓ 1 switch
- ✓ 3 additional pieces of 3 inch insulated wire pre-stripped on the ends
- ✓ 1 additional light bulb

Baggie #2 with:

- ✓ A picture of a parallel circuit
- ✓ 2 pieces of 6 inch insulated wire pre-stripped at the ends and in an additional section _ of the way down to make it easier for students to build parallel circuits.
- ✓ 5 additional 2-3 inch insulated wires, pre-stripped on the ends
- ✓ 1 cell with cell holder
- ✓ 2 light bulbs with light bulb holders
- ✓ 1 switch

PREP FOR TEACHERS

- Use wire cutters to strip the ends of all wires. Prepare both baggies with above mentioned materials.
- Make sure all batteries are fresh
- **Cue** video tape to the screen that says Electromagnetic Energy
- Go to www.brainpop.com. Click on Science movies. Click on movie, "Atoms." It will take several seconds for the movie to load. The movie will not play until you press the play button..
- *Once the students have watched the clip from www.brainpop.com on atoms*, go up to the top of the screen where the movies are listed and scroll down to the movie on batteries.
- Make sure handouts entitled **Focus for Media Interaction** are copied for each student
- Label a large post it or a piece of chart paper-**Vocabulary**
- Write your objectives and your Focus for Media Interaction on an overhead, the board or on a power point.
- For day 2, Write your objectives and your Focus for Media Interaction on an overhead, the board or on a power point.
- For day 2, Go to www.brainpop.com. Click on Science movies. Click on movie, "Electricity." It will take several seconds for the movie to load. The movie will not play until you press the play button. Use the skip forward button until you see the frame with a large brown wire with small blue dots labeled, e for electrons.

INTRODUCTORY ACTIVITY: SETTING THE STAGE (Engage)

1. Give partners a light bulb, a wire and a cell. Ask them to make the light bulb light up. Give students time to figure out how to complete the circuit. Ask them to explain why the light bulb comes on when you hold all the components together in a certain way. Ask what the wire, the cell and the light bulb completes (a circuit).

2. Write the word circuit on the vocabulary chart- with a dash-Ask the students to tell you what they used to complete their circuits. They should say: bulb, cell, and wire. Write those words next to the dash. Explain to students that battery refers to more than one cell. When we only have one battery, it is called a cell. Ask the students if they had to place the objects in a particular way in order for the light to come on. On chart paper draw the circuit. Ask the students if all the objects had to be touching in order for the light to come on.

3. Ask students to tell you what happens if you have all the components of a circuit in the correct order, but the plastic part of the wire is touching the cell.

(The light bulb will not come on.) Ask them what the plastic part of the wire is called (the insulator). Ask them what the copper part of the wire is called (the conductor). If they don't know the terms introduce them. Include insulator and conductor on the vocabulary chart.

4. Tell students they are going to work with a partner to build a circuit with a switch. Give partners a baggie with pre-cut and stripped wire (each wire should be about 3 inches long), a light bulb holder, a cell holder and a switch. Ask participants to tell you what is in the bag. Ask participants to use the materials they already have, those in the baggy and what they already know to complete a circuit. Tell them their circuit must include the switch.

5. Give students the opportunity to build the circuits. Circulate around the room asking questions to help students get on the right track. Have students demonstrate a closed circuit, (by closing the switch and turning the light bulb on), and an open circuit, (by opening the switch so the light bulb turns off. Have all the students close their circuits so the lights are on. Ask them why the light bulb comes on when the switch is closed but does not when the switch is open. (Accept answers that communicate the flow of energy. Students might say that the electricity can flow through a closed circuit, but can not flow through an open circuit, because there is a break, a gap an opening that the electricity or energy can not cross.

6. Write the question-"What makes a light bulb light up?" on the board or chart paper. Write student responses on the board or chart paper (Accept student responses. Ask them to watch the video clip to see if their answers are correct)

LEARNING ACTIVITIES (Explore, Explain)

Step 1
Provide students with a **Focus for Media Interaction** by asking the students to watch the video clip to see what type of energy makes a light bulb come on. **Start** the clip at the subtile-Electromagnetic Energy. **Stop** the clip after the narrator says " . . . and it's even in lightning." Tell the students to write down their answers next to #1 on their Electricity and Magnetism sheets.

Step 2
Rewind the clip to the screen that says Electromagnetic Energy, so that students can view it again in a few minutes. Once the students have watched the clip once, revisit the question, "What makes a light bulb come on?" (Electromagnetic energy)

Step 3
Ask the students what atoms have to do with electricity? (Accept reasonable answers: all things are made of atoms, electrons have a negative charge and electromagnetic energy. Some students may not know. Tell them they are going to watch a short movie to learn more about atoms. Once they watch the clip from Brainpop.com on atoms, the Electromagnetic Energy clip should be clearer.)

Step 4
Provide students with a **Focus for Media Interaction**- Ask the students to watch the clip so they can tell you what an atom is. *You should already have www.brainpop.com ready to go. You should also have already clicked science movies, and atom (see teacher's preparation).*

Step 5
Press the **play** button in the right hand corner of the movie screen. Play **the clip until Tim says, "Air, water, pants, sleeves and humans, are all** made of atoms. This clip is about 30 sec. **Press the mute button** on your computer. Press the **skip forward** button at the bottom of the movie screen until you get to the blank green screen. **Take the mute button off** your computer.

Step 6
Ask students to tell you some of the things atoms are made of.

Step 7
Provide students with a **Focus for Media Interaction**. Tell the students to watch the clip to identify the 3 particles an atom. Have them write down the 3 particles on their Electricity and Magnetism-Focus for Media Interaction sheets. Ask them to indicate what type of charge each particle has. (electrons -, protons +, neutrons-neutral. Press the **play** button at the bottom of the movie screen. Press **stop** when you hear Tim say that electrons live in shells representing different energy levels. Go to the top of the screen and pick the movie on batteries. **Do not press play**. You will use this clip later in the lesson.

Step 7
Ask the students to tell you what they just learned about. Add the words atoms, protons, neutrons, and electrons to your vocabulary chart. Discuss what type of electrical charge each particle has. If students have difficulty, repeat step #7.

Step 8
Provide a Focus for Media Interaction. Ask students to watch the clip from brainpop.com to find out what happens when electrons move through wire. Play the "Energy" video tape, starting with the screen Electromagnetic Energy. Give the students the viewing sheet with specific questions about Electromagnetic Energy. (See the attached handout) Students view the same clip for the second time. They write the answers to the questions on the handout as they go. The questions on the handout are:

- What makes a light bulb light up?
- The energy associated with moving electricity is called _____.
- What is all matter made of_____.
- What are the parts of an atom _____, _____,_____.

Step 9
Pause the video tape at the word particles. (You will see what appears to be a brick with blue dots floating around inside of it.) Ask the students, "What is all matter is made of?" (atoms) Say to the students, "Give me examples of those things made up of atoms." (Encourage the children to list a variety of different examples, until they realize everything is made of atoms).

Step 10
Press Play. (This section is on atoms) **Stop the tape** as soon as the narrator says, electrons carry and electric charge. Ask the students what the parts of an atom are.(The tape discusses the nucleus and electrons. It does not mention protons and neutrons.) While the tape is on, **pause** and point to the nucleus. Ask the students if they know the parts of the nucleus (protons and neutrons). Point to the red dots representing electrons, ask the students if they can identify the particle you are pointing to (electron). Ask the students what type of charge electrons have. (a negative charge, or and electrical charge). Ask them to tell you what type of charge a neutron has, point to the nucleus (a neutral charge.) Ask them what type of charge the proton has (a positive charge.)

Step 11
Ask students if they can tell you why the light bulb comes on. When they answer because of Electromagnetic energy, write it on the vocabulary chart.

Step 12
Go back to the circuit students built. Ask them to add one more light bulb. Ask students to observe what happens to the light bulbs. (they become dimmer).Ask students to explain why. (Both light bulbs are pulling energy from the battery through one path.) Ask them to tell you what type of circuit this is called. If they can not tell them it is a series circuit. Explain that the bulbs are in a series.

Step 13
Ask student to predict what will happen if they take one light bulb out. Ask them to explain why the light goes out. (Once the bulb is taken out the circuit is broken again. Electrons do not have a complete path, circuit to follow.)

Step 14
Ask student to tell you what the parts of a circuit are(the cell, wire, light bulb, switch). Tell students they are going to look closely at the battery, wire and the light bulb).

Step 15
Provide the students with a **Focus for Media Interaction.** Ask them to watch the video clip to see what batteries have to do with electrons. Go to the battery movie on www.brainpop.com. **Press play.** Do not stop the video until Tim gets into the bed.

Step 16
After the students have viewed the clip, ask them to explain what happens to the battery once it becomes a part of a circuit.

Step 17
Press the **Skip back** button to the picture of the battery and the circuit with the yellow dots representing the electrons traveling along the wire. Press the mute button on your computer. Press the pause button so you have a still picture with no sound. Keep this picture up so it can by used when you bring closure to the lesson.

Step 18
Ask students to tell you what they've learned. Make sure they explain the components of a circuit, insulators and conductors, the relationship between atoms and electricity, the difference between an open an closed circuit, and what makes a light bulb light up.

CULMINATING ACTIVITY (Extend/Apply)

Culminating Activity-Day 2

Step 1
Go to the electricity movie on www.brainpop.com. **Press play and mute. Skip forward** to the frame with the large brown wire with small blue circles labeled e, for electrons**. Provide a Focus for Media Interaction,** ask the students to watch to find out what electrical current consists of (a flow of electrons through a conductor). **Take the mute off and press play. Press Pause** after the narrator says, "Electricity flows through the circuit delivering electricity to the light bulb."

Step 2
Call on students to use the displayed picture of the circuit to explain the components of a series circuit (Energy source, energy path, energy receiver). Question them so that they explain the following: insulators and conductors, the relationship between atoms and electricity, the difference between an open an closed circuit, and what makes a light bulb light up.

Give students :
Baggie #2 with:
- ✓ 2 pieces of 6 inch insulated wire pre-stripped at the ends and in an additional section _ of the way down to make it easier for students to build parallel circuits.
- ✓ 5 additional 2-3 inch insulated wires, pre-stripped on the ends
- ✓ 1 cell with cell holder
- ✓ 2 light bulbs with light bulb holders
- ✓ 1 switch

and a picture of a parallel circuit

Step 3
Allow students to use the picture of a parallel circuit and the above mentioned materials to set up a parallel circuit. Circulate around the room providing assistance as needed.

Step 4
Once students have the parallel circuit in place, ask them to predict what will happen once they remove one of the light bulbs.

Step 5
Allow them to remove a light bulb. Ask student to explain why the other bulb stays on. Encourage them to use the vocabulary used throughout the lesson-circuit, electrons, path, energy source, etc.

Step 6
Bring closure to the lesson by having students compare and contrast parallel and series circuits. (In a series circuit there is one path from the energy source to the light bulb or load. So when you remove a light bulb from a series circuit, the circuit becomes open and electrons cannot flow through the break to light the other bulb. In a parallel circuit there is more than one path from the energy source to the light bulb, so when you remove one bulb, the other still is connected to the energy source through its own path.)

CROSS-CURRICULAR EXTENSIONS (Extend/Apply)

Social Studies/Language Arts/Science
Have students research scientists of African descent who contributed to the field of electricity. Lincoln Hawkins was responsible for lengthening the life of rubber for the insulators we use in our homes today.

As a result of his work, rubber can now last up to 70 years. Lewis Latimer worked with Thomas Edison and was responsible for creating the carbon filament The sites below have information on the above mentioned scientists and others.
http://www.blackpioneers.org/Black%20Pioneers.htm
http://www.princeton.edu/~mcbrown/display/faces.html

Science/Art
Allow students to create an art project that has areas that actually light up. They can apply their knowledge of circuits, use paper clips, brad fasteners, wires and light bulbs to light up their art work.
Social Studies/Science
Have students research the energy shortage in California. Ask them to find out the cause and effect. Have them come up with solutions in case of further energy shortages.

COMMUNITY CONNECTIONS (Extend/Apply)

Invite someone from your local power company to come to the school and discuss how they read your meter, how they determine the cost, what might make the costs increase, the energy shortage in California, etc.

Invite someone from Glovis technologies to present on African contributions in science. You can reach them at www.glovis.com. Glovis technology is an organization dedicated to infusing the contributions of African American scientists into the educational process. They are a tremendous resource, offering, in-service training, demonstration lessons and materials.

Invite a neighborhood electrician in to discuss his/her career.

Electricity and Magnetism
Focus for Media Interaction

1. What makes a light bulb light up?

   _____

   _____

   _____

2. What is all matter made of?

   _____

   _____

3. What are the three parts of an atom:

   _____, _____,

   _____.

4. The energy associated with moving electricity is called

   _____

   _____

   _____