Introduction to Electricity

Grade Level: 1st grade
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Length of Unit: Six lessons (6 – 8 days; 1 day = approximately 60 – 90 minutes)

I. ABSTRACT

In this unit first graders will develop a beginning understanding of electricity by experimenting with static electricity and making their own electrical circuits. They will learn about how electrons in atoms produce electricity, about electricity's relationship with magnets, and how a power plant can supply electricity to an entire city. In addition, students will distinguish between conductors and insulators through experimentation and will learn about how they can stay safe around electricity.

II. OVERVIEW

A. Concept Objectives
   1. Students understand the processes of scientific investigation. (Colorado State Science Standard #1)
   2. Students know and understand common properties, forms, and changes in matter and energy. (Colorado State Science Standard #2)
   3. Students know and understand interrelationships among science, technology, and human activity and how they can affect the world. (Colorado State Science Standard #5)

B. Content from the *Core Knowledge Sequence*
   1. Introduction to Electricity (pg. 38)
   2. Basic concept of atoms (pg. 38)
   3. Thomas Edison (pg. 39)

C. Skill Objectives
   1. The students will identify an atom as the smallest particle of which everything is made.
   2. The students will understand that electrons are part of an atom that moves in a path around the center.
   3. The students will understand that electricity occurs when electrons are caused to move out of their path.
   4. The students will know the difference between a closed and open circuit.
   5. The students will be able to identify static electricity.
   6. The students will understand that static electricity is short-lived and does not travel in a circuit.
   7. The students will participate in experimentation in order to identify objects that can become charged with static electricity.
   8. The students will make their own mini-generator.
   9. The students will distinguish between insulators and conductors.
   10. The students will complete a chart identifying whether specific electrical items produce heat, light, motion, and/or sound.
   11. The students will identify different sources that power plants use in order to produce electricity.
   12. The students will construct an electrical circuit.
   13. The students will experiment with their circuits to determine whether objects are conductors or insulators.
   14. The students will identify Thomas Edison as the person who invented the electric bulb.

15. The students will know that a filament is the conductor that is used inside of a light bulb.
16. The students will identify thread as the conductor and carbon as the insulator in the first light bulb.
17. The students will understand that Thomas Edison worked with other people on his experiments and that his initial experiments were not always successful.
18. The students will identify a variety of ways in which they can stay safe around electricity.
19. The students will develop a poster illustrating an electrical safety rule.
20. The students will identify themselves and water as being good conductors of electricity.

III. BACKGROUND KNOWLEDGE

A. For Teachers
   1. Hirsch, Jr. E.D. *What Your First Grader Needs to Know*. New York: Dell Publishing, 1998. ISBN 0-385-31987-8.
   2. Tomecek, Steve. *Teaching Electricity*. New York: Scholastic, Inc., 1999. ISBN 0-590-39018-X.

B. For Students
   1. It would be helpful for students to have an understanding of atoms and different types of matter, but not necessary.

IV. RESOURCES

A. *Switch On, Switch Off*, by Melvin Berger (Lessons One and Three)
B. *What Your First Grader Needs to Know*, by E. D. Hirsch (Lesson Two)
C. *The Magic School Bus and the Electric Field Trip*, by Joanna Cole and Bruce Degen (Lesson Three and Four)
D. *Thomas Edison and the Electric Field Trip*, by Living History Productions (videotape) (Lesson Five)

V. LESSONS

Lesson One: Electrified Electrons (approximately 30 – 45 minutes)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students know and understand common properties, forms, and changes in matter and energy.
   2. Lesson Content
      a. Introduction to electricity
      b. Basic concept of atoms
   3. Skill Objective(s)
      a. The students will identify an atom as the smallest particle of which everything is made.
      b. The students will understand that electrons are part of an atom that moves in a path around the center.
      c. The students will understand that electricity occurs when electrons are caused to move out of their path.
      d. The students will know the difference between a closed and open circuit.

B. *Materials*
   1. One hoola-hoop for every three students
   2. Chart paper
   3. *Switch On, Switch Off* by Melvin Berger

4. Appendix A - one copy for each student

C. *Key Vocabulary*

1. Atom – the smallest particle of which everything is made
2. Electrons – part of an atom that moves in a path around the center of the atom; electricity occurs when they're caused to move out of their path
3. Magnet – a piece of iron, steel or lodestone that can attract iron or steel
4. Compass – an instrument that shows direction with a magnetic needle that points north

D. *Procedures/Activities*

1. Tell the students that they will be learning about electricity and how electricity works. Have the students share what they already know about electricity by listing their responses on the chart paper. Split the chart paper into two different columns. Label the first column "What I Know About Electricity." Label the second column "What I've Learned About Electricity." Write their initial responses in the first column. Save the second column for reviewing what they've learned after each day's lesson.
2. Read to the students the book *Switch On, Switch Off*, by Melvin Berger. Ask the following questions either during the reading of the book or after the book has been read.
   a. What were the three things that the kids in the book used to make electricity? *(wire, magnet, and compass)*
   b. What is the name of the tiny particles that everything is made up of? *(atoms; Remind students that atoms are too small to see.)*
   c. What is the name of the tiny particles that move around the center of an atom? *(electrons; Closely show the students the illustration on page 14.)*
   d. What needed to be moved near the wire to make the electrons move out of their path? *(a magnet)*
   e. What do they call a large machine that makes electricity? *(a generator)*
   f. In the book the kids were able to make their little generator work by moving the magnet with their hands. What was used to make very large generators move? *(wind, flowing water, steam)*
   g. What is the loop or path where electricity travels called? *(a circuit)*
   h. What happens when there is a break in the circuit? *(The electricity stops flowing.)*
   i. When something needs to be plugged in at home, where do you plug it in? *(an outlet)*
   j. When you switch something on at home, what are you doing to the circuit? *(closing the circuit)*
   k. What are you doing to the circuit when you switch something off? *(breaking the circuit)*
3. Remind the students that absolutely everything is made up of atoms and that electrons move around the center of each atom. Have the students demonstrate this by splitting the class into groups of three. Each group should stand inside the hoola-hoop, representing one atom. One person stands in the middle as the center of the atom. The remaining two students move around the middle student. They are the electrons.
4. Have the "atoms" form a giant circle, ensuring that they are touching. Tell the students that electrons actually jump from the atom, or the path that they were following, causing electricity to occur. Explain to the students that they will be demonstrating how a circuit, or path, of electricity occurs by having one "electron" from one atom move to the next atom. When the student, or electron,

moves to the next atom, an electron from that atom moves to the next atom, and so on. Have the students continue this until they get around the whole circle of "atoms." Tell them that they have just demonstrated how electricity travels through a circuit. Then instruct the electrons to go through the circuit again. This time make sure that the students (electrons) that did not get to move the first time get to go around the circuit the second time.

5. To better relate this activity to what happens when we turn switches on and off, play music as the electrons travel around the circuit. When the music is turned off, the electron (or student) that is moving should stop and those two atoms should separate. Explain to the students that the circuit is now open. Therefore, electricity cannot flow. When the music is turned back on, the atoms should rejoin and the electrons begin moving from atom to atom again. Explain to the students that this is called a closed circuit. The electricity can now flow again.
6. Close this lesson by having the students verbalize what they learned during the lesson about electricity. List their responses on the second column of the chart paper.
7. Have the students complete Appendix A. *(The answers for Appendix A are as follows: 1 – atoms; 2 – electron; 3 – magnet; 4 – generator; 5 – flowing water; 6 – opening, or breaking, the circuit)*

E. *Assessment/Evaluation*

1. The students will be assessed based on their completion of Appendix A.

Lesson Two: Title Static Electricity (approximately 60 – 90 minutes)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students understand the processes of scientific investigation.
   b. Students know and understand common properties, forms, and changes in matter and energy.
2. Lesson Content
   a. Static electricity
3. Skill Objective(s)
   a. The students will be able to identify static electricity.
   b. The students will understand that static electricity is short-lived and does not travel in a circuit.
   c. The students will participate in experimentation in order to identify objects that can become charged with static electricity.

B. *Materials*

1. 3" x 5" inch index card for each student
2. One pencil for each student (sharpened and wooden)
3. Small lump of clay for each student
4. Piece of silk fabric for every three to four students
5. 12" x 12" inch piece of clear plastic for every three to four students
6. One of each of the following test items for every three to four students: wooden popsicle stick, plastic straw, plastic comb, metal spoon, metal scissors, glass eyedropper, and a glass light bulb)
7. One balloon for each student
8. One piece of tissue paper for each student
9. Appendix A – pass back graded papers and make one overhead copy
10. *What Your First Grader Needs to Know*, by E. D. Hirsch, Jr.
11. Appendix B – one copy for every student
12. Appendix C – one copy for every student and one overhead copy

13. Appendix D
14. Appendix E – one copy for every student

C. *Key Vocabulary*

1. Static electricity – stationary electrical charges; usually caused by friction

D. *Procedures/Activities*

1. Review the previous lesson by reading what they learned about that lesson from the chart paper labeled "What I've Learned About Electricity." Have the students read this together. Also go over the questions from yesterday's assignment, Appendix A. Pass back these graded papers and go over the assessment with the class on the overhead. Tell the students to make sure that the correct answer is clearly marked so that they can use this assessment to study for the final test.
2. Explain to the students that today they will be learning about static electricity. Ask the students if they've heard of static electricity and invite them to share any experiences they've had with static electricity.
3. Read to the students the section about static electricity from the book, *What Your First Grader Needs to Know*. This can be found on pages 299 and 300.
   a. What was a way that we can create static electricity? *(running a comb quickly through your hair; rubbing a balloon on the wall or in your hair)*
   b. A little zap of electricity works the same way as what? *(a lightening bolt)*
4. Also ask the students if they think static electricity could make a light bulb glow or turn on the radio. Tell the students that, of course, the answer would be no. Explain to the students that static electricity causes electrons to jump, but those electrons are not able to keep traveling from one atom to another, as was demonstrated in yesterday's lesson.
5. Tell the students that we would not have so many things today that run with electricity if it wasn't for people who were willing to experiment, and many of these experiments began with static electricity. These experiments helped people know which types of material allowed electricity to travel through it. Explain that in today's lesson they will be doing their own experiments with static electricity to see which types of materials they can make become "electric."
6. First, give each person a balloon. You may want to blow the balloons up before the lesson, as many first graders will not be able to blow it up. Also give each student a piece of tissue paper. Instruct the students to tear their piece of tissue paper into small pieces and scatter on their desk. Then have the students rub the balloon vigorously on the top of their head. Using their charged balloon, challenge the students to use the balloon to pick up as many pieces of tissue paper from their desk as possible, without actually touching the paper.
7. Explain to the students that the plastic on the balloon and their dry hair was great for making static electricity. They will now be testing other objects to see if they can make more static electricity.
8. For the next experiment, split the class into group of 3 or 4 so that they can share materials and compare results. They will be making their own "static tester." The directions are printed on Appendix B. Depending on the reading level of your students, you can have the students read these directions or give the directions orally. Only pass out the materials needed to make the static tester at this time.
9. After all of the students have made their static tester, pass out the following test items for each group: wooden popsicle stick, plastic straw, plastic comb, metal

spoon, metal scissors, glass eyedropper, glass light bulb, plastic wrap and silk fabric

10. Also pass out a copy of Appendix C at this time. Tell the students that they will be rubbing each item with the piece of plastic wrap and the silk fabric to see if they can produce static electricity. Once the item has been rubbed for approximately 30 seconds, the students need to bring that test item near one end of the folded card that is on the static tester. Instruct the students to bring the item near the static tester, but do not touch it. If the static tester moves when the object gets close to it, the object has been charged.
11. Demonstrate this to the students by rubbing one of the test items with the plastic wrap and the fabric. Show the students how to count 30 seconds by watching the second hand on your wall clock. Then, using your overhead copy of Appendix C, show they students how to fill in the chart. For example, if rubbing the plastic wrap on the plastic comb makes the static tester move, write yes in the appropriate box. If rubbing the silk fabric on the plastic comb does not make the static tester move, then write no in that box.
12. Instruct the students to complete questions 1 & 2 on Appendix C before beginning their experimentation. These are prediction questions and there is no correct answer. Questions 3 through 7 should be completed after they have tested all of their items and completed the chart. Remind the students to share the items with their peers and that it is not necessary to test the items in order.
13. After Appendix C has been completed, encourage the students to share their findings with the class. Also, go over questions 3 – 7 as a whole group. Students may have different answers for questions 3 & 4. The answer to question 5 should be yes. They should have noticed that the metal objects do not get charged at all. This should include the metal spoon and the metal scissors. The answers for questions 6 & 7 should be the plastic straw and the plastic comb and they are both made of plastic. Hopefully, the students also noticed that the glass objects could only be charged with the silk fabric.
14. To conclude the lesson, have the students verbalize what they learned about electricity and write their responses on the chart paper that was introduced in lesson one.
15. To further review the important points of the lesson, have the students complete the sentences on Appendix E by using the word bank. If teaching this unit early in the year, you may opt to read the sentences and word bank choices to or with the students. The answers for this appendix are as follows: *(1. electricity; 2. static electricity; 3. electrons; 4. circuit; 5. experimented; 6. plastic wrap; 7. silk fabric)*

E. *Assessment/Evaluation*

1. The students will be assessed on their static electricity experiments and Appendix C by using the rubric on Appendix D.
2. The students will be assessed on their completion of Appendix E.

Lesson Three: Title Using Electricity (approximately one hour)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students know and understand common properties, forms, and changes in matter and energy.
2. Lesson Content
   a. Introduction to Electricity

3. Skill Objective(s)
    a. The students will make their own mini-generator.
    b. The students will distinguish between insulators and conductors.
    c. The students will complete a chart identifying whether specific electrical items produce heat, light, motion and/or sound.
    d. The students will identify different sources that power plants use in order to produce electricity.

B. *Materials*
1. *The Magic School Bus and the Electric Field Trip*, by Joanna Cole and Bruce Degen
2. *Switch On, Switch Off*, by Melvin Berger (optional)
3. Compass (one for every four students)
4. Bar magnet (one for every four students)
5. Piece of thin copper wire that is at least 6 ft. in length (one for every four students)
6. Wire stripper (to strip a bit of insulation off of each end of the wire)
7. Chart paper
8. Pinwheel (one for each student would be great, but not necessary)
9. Appendix F – one copy for each student and one overhead copy
10. Appendix G – one copy for each student

C. *Key Vocabulary*
1. Compass – an instrument used for showing direction; contains a magnetic needle that points north
2. Turbine – an engine driven by the pressure of steam, water, air, etc. against the curved vanes of a wheel

D. *Procedures/Activities*
1. Review the previous lessons by reading what they've learned so far about electricity on the chart labeled, "What I've Learned About Electricity." Also pass back Appendix E and go over each question with the class. If you've chosen to grade this paper, have the students make any necessary corrections as each question is discussed.
2. Have the students brainstorm a list of items that are run by electricity and write their responses on a large piece of chart paper. Many students will want to list items that run with the use of batteries. Explain to the students that batteries actually store electricity. Since they do depend on electricity to work, create a separate column on your chart paper for items that use batteries. Keep this chart hanging in the room for the students to see and so that the students can add items to the chart as the unit continues.
3. Introduce the book *The Magic School Bus and the Electric Field Trip*, by Joanna Cole and Bruce Degen. Tell the students that even though this is a fun book, it is also very long. Therefore, you will only be reading part of the book today. Begin by reading through page 25. Ask the following questions either during or after the reading.
    a. What can electricity make things do? *(produce heat, light, movement, and sound; The book does not mention sound so you will need to add this.)*
    b. What is everything made up of? *(atoms)* Can you see atoms? *(no)*
    c. What is the name of a tiny part of an atom that can jump to other atoms causing electricity to occur? *(electrons)*
    d. When electrons "run" through a wire (from atom to atom), what is created? *(a current; Remind the students that they demonstrated this on*

the first day of the unit when they created their circuit (or circle) of atoms.)

e. Remember from the book that insulators block electricity, which means that electricity can't travel through those objects well. What were some good insulators? *(plastic, rubber, wood, glass, air)*

f. Conductors are objects in which electricity can easily pass through. What were some good conductors? *(metal, water, acids)*

g. What was wrapped around the wire to keep the electricity flowing in the wire and away from us? *(plastic)* Would the plastic around the wire be an insulator or a conductor? *(an insulator)*

h. What is the name of the place where electricity is made? *(power plant)*

i. When the students in Ms. Frizzle's class made their own mini-power plant, what was needed to pass through the coil of wires in order to make the electrons begin moving inside the wire? *(magnet)* Remind the students that they also read about this in the book *Switch On, Switch Off*, by Melvin Berger. In that book their "mini-power plant" was called a generator.

j. Remind the students that the generator in the power plant is very large. The magnet inside that generator cannot be moved by hand. What can be used to make the generator turn? *(burning fuel to create steam, water, and wind)*

k. What was used to make the generator move in the book? *(Coal was burned to produce steam.)*

4. Remind the students that in the power plant the turbine had to move first. The turbine was then attached to the generator making it move. Show the students a pinwheel and explain to the students that blades on a turbine are a lot like the pinwheel. Blow on the pinwheel to show how wind makes it move.

5. Split the class into groups of four and have each group make their own little generator. Each group will need a 6 ft. piece of copper wire, a bar magnet and a compass. Prior to this lesson, strip the plastic insulation off of each end of the copper wire for the students.

6. Instruct one of the students in each group to wrap one end of the wire around their hand about ten times and then carefully slide the coil of wire off of their hand. Then instruct another student in each group to wrap the wire around the compass about five times. The wire needs to stay on the compass. Next, have a third student in each group twist the two metal ends of the wire together so there is one big loop. After the loop, or circuit, has been completed, have the last student in each group move the magnet quickly back and forth inside the coil of wire. This is the coil that was created when the first student wrapped it around his/her hand. There is also a good illustration of this on page 12 of *Switch On, Switch Off* by Melvin Berger.

7. As the magnet is moving inside of the coil of wire, the needle on the compass will begin to move. Explain to the students that the moving needle means that electricity is flowing. Ask the students again what is jumping from atom to atom in order to make electricity flow. *(electrons)*

8. Also remind the students that the generator that they made is very, very small compared to a generator in a power plant. Explain that the generator in a power plant can supply electricity to a large city.

9. To reinforce that electricity supplies energy in the form of motion, sound, light and sound, have the students complete Appendix F as a homework assignment. Or, if you wish, this could also be an in class assignment. Have the students list

items that run on direct electricity rather than batteries. Using the overhead copy of Appendix F, illustrate how to properly fill in the chart. For example, write "oven" in the box directly under electrical items. Then to the right, put an X in the box that is directly under heat because that is what electricity produces in an oven. This activity is from the following source: The Education Center, Inc. The Mailbox, Primary, Dec/Jan., 2000-2001.

10. Have the students list what they've learned about electricity on the chart paper that is labeled, "What I've Learned About Electricity." Also, assess their understanding of this lesson by having them complete Appendix G. This appendix may need to be read to the students if they are not yet reading. The answers for Appendix G are as follows: *(1 – e; 2 – g; 3 – f; 4 – b; 5 – d; 6 – h; 7 – c; 8 – a)*

E. *Assessment/Evaluation*

1. The students will be assessed based on their completion of Appendices F and G.

Lesson Four: Title Electrical Circuits (approximately 90 minutes)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students understand the processes of scientific investigation.
   b. Students know and understand common properties, forms, and changes in matter and energy.
2. Lesson Content
   a. Introduction to Electricity
   b. Basic parts of simple electric circuits (for example, batteries, wire, bulb or buzzer, switch)
   c. Conductive and nonconductive materials
3. Skill Objective(s)
   a. The students will construct an electrical circuit.
   b. The students distinguish between an open and closed circuit.
   c. The students will experiment with their circuits to determine whether objects are conductors or insulators.

B. *Materials*

1. *The Magic School Bus and the Electric Field Trip*, by Joanna Cole and Bruce Degen
2. Size D battery for each student
3. One rubber band for each student
4. One 8" x 10" piece of cardboard for each student
5. Three 6" x ½" pieces of aluminum foil for each student
6. One clothespin for each student (use spring-type clothespins)
7. One flashlight bulb for each student
8. Clear tape (enough for students to share easily)
9. Two brass paper fasteners for each student
10. One steel paper clip for each student
11. Hole punch
12. Provide the following items for every three – four students: rubber band, metal nail, eraser, thumb tack, pencil lead (graphite), key
13. Overhead copy of Appendices F and G
14. Appendix H, pages 1 and 2 (if you require the students to read the directions independently, one copy will be needed for each student)
15. Appendix I – one copy for each student
16. Appendix J

17. Appendix K – one copy for each student

C. *Key Vocabulary*
1. Current – the flow or rate of flow of electricity through a conductor
2. Conductor – anything that allows electricity to pass through it
3. Insulator – anything that does not allow electricity to pass through it

D. *Procedures/Activities*
1. Review previous lessons by reading, as a class, what has been written on the chart at the front of the room. (What I've Learned About Electricity)
2. Using the overhead copy of Appendix F, invite students to share some of the objects that they listed on their chart when they completed Appendix F. Fill in your overhead copy with their information, making sure that students agree on what each electrical item produces. Collect this homework so that you can assess their understanding.
3. Then pass back Appendix G that the students completed in the previous lesson. If using this as an assessment, it should already be graded. Using an overhead copy of this appendix, go over each question and remind students to make corrections if necessary, if you didn't already correct while grading.
4. Read the rest of *The Magic School Bus and the Electric Field Trip*, by Joanna Cole and Bruce Degen. The reading should begin at page 26. Before beginning, invite students to share what was happening at the beginning of this book. Ask the following questions either during or after the reading.
    a. What is created when the electrons move quickly through a wire? *(a current)*
    b. When the students in Ms. Frizzle's class were traveling through the wire, where did they go first? *(a light bulb)*
    c. What is the very, very thin wire that lights up inside the light bulb called? *(the filament)*
    d. What did they travel to after the light bulb? *(a toaster)* What does electricity produce in a toaster? *(heat and light)*
    e. Next the students traveled to a power saw. What was inside the electric motor? *(magnets)*
    f. What happened when the students traveled inside the vacuum cleaner? *(They got stuck inside of the vacuum cleaner because the switch got turned off.)*
    g. When the switch was turned off, what couldn't flow through the wire anymore? *(electrons)*
    h. When the students arrived back at the school, how did they get out of the wire? *(through a hole in the insulation)*
    i. Why would it be dangerous if there were a hole in the insulation of a wire? *(someone could get shocked or it could start a fire)*
5. Remind the students that electricity needs to travel in a circuit. When a switch is turned off, the circuit is broken or open. When a switch is turned on, the circuit is closed.
6. Tell the students that they will be making their own circuits and will be experimenting with different items to see if they are conductors or insulators.
7. See Appendix H, pages 1 and 2 for instructions on how the students should create their circuits. Pass out all of the necessary materials and explain each direction to the students. It would be helpful if you demonstrated each step for the students. When I have taught this unit later in the year, I have required my students to read the directions independently or work in groups to read and follow the directions. It is a great lesson on learning to follow directions.

8. After the students have completed their circuits and they are working properly, split the class into small groups of three – four students. Each group should receive the following test items that are listed in the materials section and on Appendix I. Give each student a copy of Appendix I at this time.
9. Explain that they will be using their circuit to test whether the items are conductors or insulators. Remind the students that conductors allow electricity to pass through them. Therefore, using a conductor to complete their circuit will allow the bulb to light up. Insulators do not allow electricity to pass through them. Using an insulator to complete the circuit will prevent the bulb from lighting up.
10. The students' circuits are already using a paper clip as a conductor. When it is moved on and off of the fastener, it is acting as a switch. This paper clip can either be taken off or kept on during the experimenting, depending on the size of your test item. For example, the thumbtack will likely not reach from one brass fastener to the other. Therefore, the students can simply move the paper clip in order to create a bridge from the paper clip to the brass fastener using the thumbtack.
11. Demonstrate how to complete Appendix I using one of the test items. Explain to the students that people who conduct experiments usually have an idea, or prediction, about what might happen. The second column on Appendix I is for a prediction about whether that item might be a conductor or an insulator. Tell the students that they need to make their prediction before they actually test the item and it is okay if their prediction is wrong. If they believe the item will be a conductor, then they need to write "conductor" in that box. If the item turns out to be an insulator, then "insulator" would be written in the results column.
12. The last three spaces in the test items column are intentionally left blank so that the students can choose three items that they would like to test. After the students have completed their experimentation, invite students to share their results. Make sure that the students notice that all of the objects made of metal are conductors. Appendix J is a rubric that can be used to assess their performance on this project. Use Appendix K as a more formal assessment of this lesson. The answers for Appendix K are as follows: *1. True; 2. False; 3. True; 4. True; 5. True; 6. False; 7. True; 8. False; 9. True; 10. False*
13. Complete the lesson by having students share what they've learned about electricity. Write their responses on the chart from Lesson One. (What I've Learned About Electricity)

E. *Assessment/Evaluation*
1. The students will be assessed on their completion of a circuit and the conductor/insulator experiment by using the rubric on Appendix J.
2. The students will be assessed based on their completion of Appendix K.

Lesson Five: Title Thomas Edison (approximately one hour)

A. *Daily Objectives*
1. Concept Objective(s)
   a. Students understand the processes of scientific investigation.
   b. Students know and understand common properties, forms, and changes in matter and energy.
   c. Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.
2. Lesson Content
   a. Introduction to Electricity

b. Thomas Edison

3. Skill Objective(s)
   a. The students will identify Thomas Edison as the person who invented the electric bulb.
   b. The students will know that a filament is the conductor that is used inside of a light bulb.
   c. The students will identify thread as the conductor and carbon as the insulator in the first light bulb.
   d. The students will understand that Thomas Edison worked with other people on his experiments and that his initial experiments weren't always successful.

B. *Materials*
   1. *Thomas Edison and the Electric Light*, by Living History Productions (videotape)
   2. Overhead copy of Appendix K
   3. Appendix L – one copy for each student

C. *Key Vocabulary*
   1. Inventor – someone who develops a new device or way of doing something

D. *Procedures/Activities*
   1. Review the previous lessons by having the students read from the chart at the front of the room. (What I've Learned About Electricity)
   2. Pass back Appendix K to the students that they completed in the previous lesson. Using the overhead copy of this appendix, go over each statement with the students.
   3. Tell the students that today they will be learning about a great inventor named Thomas Edison. Explain to the students that inventors often experiment with different ideas before coming up with the "right answer." Ask the students to verbalize some of the things that they were able to come up with during their experiments throughout this unit.
   4. Introduce Thomas Edison to the students by having them watch the videotape, Thomas Edison and the Electric Light. This videotape lasts approximately 30 minutes. Use the following questions to assess their understanding of this videotape.
      a. What was Thomas Edison's main goal? *(to invent an electric light)*
      b. What is an inventor? *(someone who develops new things or new ways to do things, usually to make life easier)*
      c. What was the problem in developing the electric light? *(They couldn't find a filament that would stay bright.)*
      d. Did everyone believe that Thomas Edison could invent an electric light? *(no)*
      e. Did Thomas Edison work on his inventions by himself? *(no; He worked with a team of people.)*
      f. What did Thomas Edison and his team need to take out of the bulb to make the filament light up? *(air or oxygen)*
      g. What did he finally find as a filament that worked? *(thread)*
      h. What was used as an insulator to put around the filament? *(carbon; They made "carbon soup.")*
      i. At the end of the video, what was the year that Thomas Edison put in lights? *(1880)*
   5. Emphasize to the students that Thomas Edison was a great inventor, but he often failed many times before succeeding. If you haven't already, this would be a great time to introduce the saying, "If at first you don't succeed, try, try again."

6. Have the students complete the paragraph about Thomas Edison on Appendix L using the words at the bottom of the page. The blanks in the paragraph should be completed in the following order: *(inventor, light bulb, alone, team, oxygen, filament, conductor, thread, carbon soup, Thomas Edison)*
7. Have the students add to their list about what they've learned about electricity on the chart at the front of the room that is labeled, "What I've Learned About Electricity."

E. *Assessment/Evaluation*
1. The students will be assessed based on their completions of Appendix L.

Lesson Six: Title Electrical Safety (approximately one hour)

A. *Daily Objectives*
1. Concept Objective(s)
   a. Students know and understand common properties, forms, and changes in matter and energy.
2. Lesson Content
   a. Introduction to Electricity
   b. Safety rules for electricity (for example, never put your finger, or anything metallic, in an electrical outlet; never touch a switch or electrical appliance when your hands are wet or when you're in the bathtub; never put your finger in a lamp socket; etc.)
3. Skill Objective(s)
   a. The students will identify a variety of ways in which they can stay safe around electricity.
   b. The students will develop a poster illustrating an electrical safety rule.
   c. The students will identify themselves and water as being good conductors of electricity.

B. *Materials*
1. Appendix L – overhead copy and student graded copies
2. Piece of poster board for each student (can vary in size)
3. Marker and/or colored pencils available for students
4. Chart paper

C. *Key Vocabulary*
1. Electrical Outlet – a place where one can gain access to electricity by plugging in metal prongs

D. *Procedures/Activities*
1. Review the previous lessons by reading what has been written on the chart labeled, What I've Learned About Electricity. Also, using the overhead copy of Appendix L, review the paragraph about Thomas Edison by filling in the blanks and reading the paragraph as a whole group. As you go through the paragraph, encourage students to correct any mistakes, if necessary.
2. Tell the students that in this last lesson, they will learn how to be safe around electricity. Explain to the students that they've conducted their experiments with a battery because it gives off very little electricity. However, the electricity that is used in their homes and at school is much more powerful. Tell the students that experimenting with that electricity should never be done because it is very dangerous.
3. Many parents have likely talked with their children about the dangers of electricity. Therefore, have the students brainstorm a list of ways that they can be safe around electricity. Write their ideas on a piece of chart paper.

4. The following is a list of things that you shouldn't do around electricity. These should be added to the list if not already mentioned by the students. This list of safety tips is printed in the back of the book, *Where Does Electricity Come From?,* by C. Vance Cast.
    a. Don't spill water on anything electrical – even if it is on fire.
    b. Don't touch anything electrical with wet hands, when in the bathtub, or when standing on a wet floor.
    c. Don't poke anything (except electrical plugs) into electrical wall outlets.
    d. Don't cut or break or play with electrical wires.
    e. Don't use anything electrical if the wires are torn or broken.
    f. Don't touch the insides of a television, toaster, or anything electrical.
    g. Don't go near outdoor electric wires that are lying on the ground.
    h. Don't go near water or stand under a tree when there is a lightening storm. Go inside.
5. With each of these statements about what they shouldn't do, make sure they can answer the question, "Why?" Explain that when we touch something electrical, electricity can easily pass through us because we are good conductors. One of the reasons we are good conductors is because we have a lot of water inside of us.
6. Make sure the students understand that water is a good conductor. This is why we shouldn't use water on an electrical fire or touch anything electrical when we are standing in water or have wet hands.
7. Have each student pick one item from the electrical safety list and make a poster illustrating that safety tip. Give each student poster board and supply markers or colored pencils. Use the rubric on Appendix M to explain what your expectations are for the poster. Then use that appendix to assess the students' posters when they are completed. Encourage the students to use a pencil when initially sketching out any pictures and writing words.
8. Inform the students and parents that the students will be taking a final assessment over the information learned in this unit. Encourage the students to use their daily assessments to study for this test. Allow a day for the students to review and study for this assessment before administering it.

E. *Assessment/Evaluation*
    1. The students' posters will be assessed using Appendix M.

VI. CULMINATING ACTIVITY

A. Take a field trip to a local power plant so that students can see a large generator and learn more about how energy is used to move those generators in order to produce electricity.

VII. HANDOUTS/WORKSHEETS

A. Appendix A – Switch On, Switch Off
B. Appendix B – Build a Static Tester
C. Appendix C – Static Electricity Experiments
D. Appendix D – Static Electricity Rubric
E. Appendix E – Static Electricity Assessment
F. Appendix F – Functions of Electricity
G. Appendix G – Using Electricity
H. Appendix H – Making A Circuit
I. Appendix I – Conductors/Insulators
J. Appendix J – Circuit Project Rubric
K. Appendix K – Circuits/Insulators/Conductors

L. Appendix L – Thomas Edison
M. Appendix M – Poster Assessment
N. Appendix N – Final Assessment
O. Appendix O – Final Assessment Answer Key

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Appendix A
Switch On, Switch Off

Name _____ **Date** _____

Answer the following questions by filling in the circle next to the correct answer.

1. Everything is made up of tiny particles called _____.
   - o electricity
   - o atoms
   - o air

2. What needs to move out of its path causing electricity to occur?
   - o electron
   - o atom
   - o magnet

3. In the book Switch On, Switch Off what was used to make the electrons in the wire move from atom to atom?
   - o book
   - o compass
   - o magnet

4. By using a magnet, wire and a compass, the kids in the book made a little _____.
   - o generator
   - o magnet
   - o switch

5. Large generators can supply electricity to a whole city. What is one thing that can be used to make the magnet inside those generators move?
   - o switch
   - o fire
   - o flowing water

6. When you turn the lights off in a room, what are you doing to the circuit?
   - o closing the circuit
   - o opening, or breaking, the circuit
   - o fixing the circuit

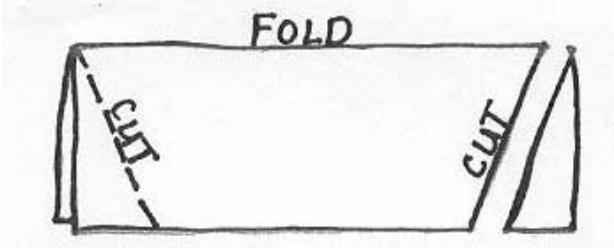
Appendix B
Build a Static Tester

(This experiment is taken from the following resource: Tomecek, Steve. Teaching Electricity: Yes, You Can! New York: Scholastic, Inc. 1999. ISBN 0-590-39018-X.)

You will need the materials:

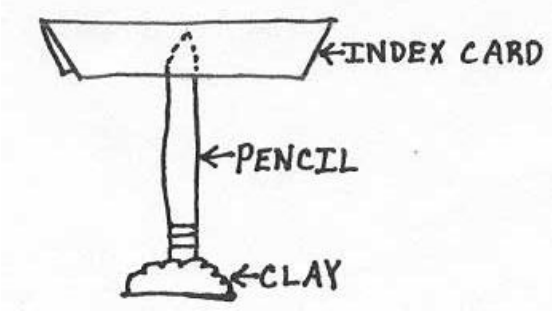
- scissors
- new wooden pencil with a sharp point
- 3 x 5 inch index card
- small lump of clay

Step 1: Fold the index card down the middle lengthwise. Cut both ends of the card at an angle so that they make a point at the top fold. (See the picture.)



Step 2: Press the lump of clay into the middle of the desk. Stick the pencil's eraser into the clay so that the pencil point sticks straight up.

Step 3: Balance the folded card on the pencil point. Gently blow on the card to see if the pointer (card) swings freely.



Appendix C
Static Electricity Experiments

Name _____ **Date** _____

1. Which object do you think will make the static tester move the most?

_____

2. Which do you think will create the most static electricity in the objects, the plastic wrap or the silk fabric? _____

Test Item	Plastic Wrap	Silk Fabric
wooden popsicle stick		
plastic straw		
plastic comb		
metal spoon		
metal scissors		
glass eyedropper		
glass light bulb		

3. Which object caused the static tester to move the most? _____

4. Was this object rubbed with plastic wrap or the fabric? _____

5. Were there any objects that didn't get charged with static electricity? ____

   What were they? _____

6. What were the items that could only be charged with plastic wrap? _____

_____

7. What did these items have in common? _____

_____

Appendix D
Static Electricity Rubric

Name: _____ **Date:** _____

Criteria	Points

	4	3	2	1	
Participation The teacher observed the student participating in the project.	**All** of the time	**Most** of the time	**Some** of the time	**None** of the time	____
Completion Of Rubric	All areas of the rubric were completed correctly and within the time allotted.	All but two sections of the rubric were completed within the time allotted.	3 to 4 sections of the rubric were not completed within the time allotted.	More than 4 sections of the rubric were not completed with the time allotted	____
Appendix C Questions	All questions were answered promptly and correctly. Any necessary changes were made during whole group discussion.	All questions were answered. However, necessary changes to the answers were not made during whole group discussion.	One or more of the questions were not answered. However, questions were completed during group discussion.	One or more of the questions were not answered. The answers were not completed during the group discussion.	____
Sharing/ Behavior The student was considerate to other group members by sharing test items and talking quietly throughout the experimentation.	**All** of the time	**Most** of the time	**Some** of the time	**None** of the time	____
TOTAL POINTS					

Appendix E
Static Electricity Assessment

Name _____ Date _____

Complete the following sentences by using the words in the word bank at the bottom of the page.

1. _____is the power that makes your radio, TV or your refrigerator work.

2. If you touch something and feel a shock, you are experiencing _____ _____.

3. When static electricity happens, _____ from an atom jump, or move out of its path.

4. Static electricity is not powerful enough to make your radio play music because it cannot travel in a _____.

5. We are able to use electricity today because many people have _____ with electricity.

6. When we experimented with static electricity, we needed to use the _____ _____ to make the plastic items become charged.

7. We need to use the _____ _____ to make the glass items become charged.

Word Bank:

circuit	**silk fabric**	**electricity**	**static electricity**
experimented	**plastic wrap**	**electrons**	

Appendix F
Functions of Electricity

Name _____ Date _____

Functions of Electricity				
Electrical Items	Light	heat	sound	motion

Appendix G
Using Electricity

Name _____ **Date** _____

Draw a line from the sentence on the left to the word on the right that matches. Each sentence has one correct match.

1. This is what electricity produces in a fan.	a. heat and light
2. This is what moves from atom to atom when electricity is flowing.	b. insulator
3. This is connected to the generator in a power plant to make it move.	c. magnet
4. This is what plastic is because it doesn't allow electricity to pass through it.	d. conductor
5. This is what the copper wire is because electricity can travel through it.	e. motion and sound
6. This was used in the book to make the turbine and generator move.	f. turbine
7. This is inside a generator and is needed to make electricity.	g. electrons
8. This is what a light bulb produces because of electricity.	h. steam

CIRCUIT DIRECTIONS

These circuit directions, although slightly modified, are taken from the following source: Tomecek, Steve. Teaching Electricity. New York: Scholastic, Inc., 1999 ISBN 0-590-39018-X.

Each student will need the following items:

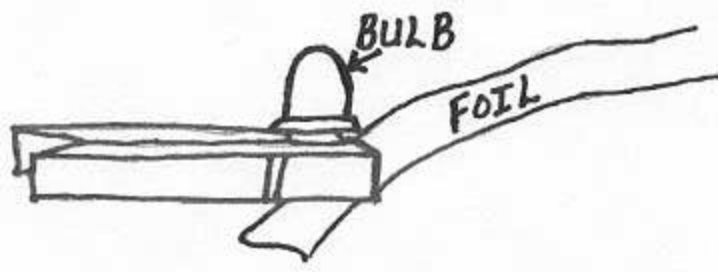
size D battery
three 6" x ½" foil strips
flashlight bulb
spring-type clothespin
rubber band
8" x 10" piece of cardboard
2 brass paper fasteners
steel paper clip
tape
hole punch

**Many 1st graders will not be able to punch a hole through the cardboard as indicated in Step #8. This is something that an adult will likely need to help with.

1. Use a pen or pencil to label each piece of foil with a 1, 2, and 3.

2. Wrap one end of foil strip #1 around the base of the flashlight bulb. Use the clothespin to hold the strip of foil onto the base of the bulb.

3. Tape one end of foil strip #2 to the bottom of the flashlight bulb.

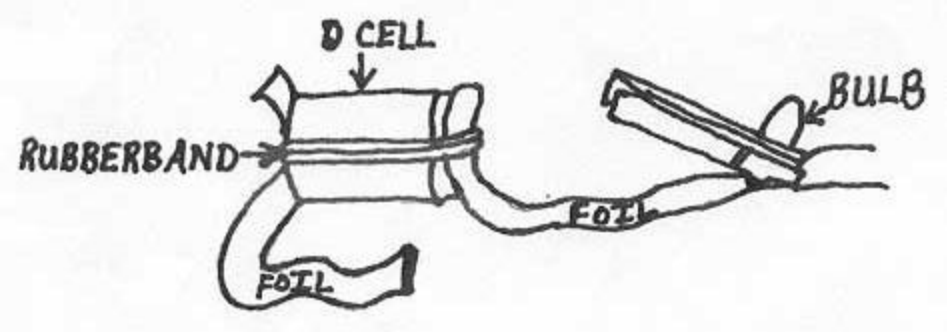


4. Wrap the rubber band around the battery two times lengthwise. The rubber band needs to be over the negative and positive ends of the battery. Tape the rubber band to the battery.

5. Place one end of foil strip #2 under the rubber band at one end of the battery. Use the end that is not taped to the flashlight bulb.

Appendix H, pg. 2
Making A Circuit

6. Slip one end of foil strip #3 under the rubber band on the opposite end of the battery. Now tape the entire battery to the piece of cardboard.

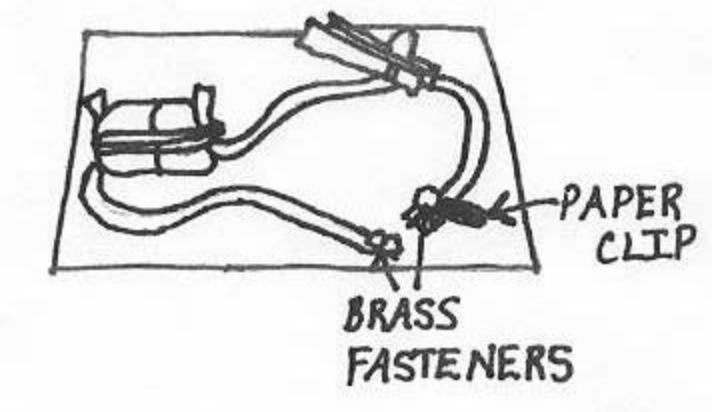


7. Punch a hole near the two free ends of the foil strips. Put the brass fasteners through the holes in the strips.

8. Then push the fasteners through the cardboard. Make sure that the distance between the two fasteners is a little less than the length of the paper clip.

9. Open the fasteners underneath the cardboard. Make sure they don't touch each other. Tape these in place.

10. Slip the paper clip around the head on one of the fasteners. When the other end of the paper clip is moved to touch the other fastener, the circuit is complete. The flashlight bulb should light up!! Now you can open and close your circuit by moving the paper clip.



Appendix I
Conductors/Insulators

Conductor or Insulator?

Name _____ **Date** _____

Test Items	Prediction	Results
rubber band		
metal nail		
eraser		
thumb tack		
pencil lead (graphite)		
key		

Appendix J
Circuit Project Rubric

Name _____ **Date** _____

Criteria					Points
	4	3	2	1	
Following Directions For Completing An Electrical Circuit (Redirection can mean correcting off-task behavior or needing to fix student mistakes when necessary.)	The student accurately followed teacher directions. No redirection was needed.	The student needed to be redirected 1-2 times when following teacher directions.	The student needed to be redirected 3-4 times when following teacher directions.	The student needed to be redirected 5 or more times when following teacher directions.	_____
Completion of Conductor / Insulator Graph	All areas of the graph were completed within the allotted class time.	All but two boxes in the graph were completed within the allotted class time.	3 to 4 boxes in the graph were not completed within the allotted class time.	More than 4 boxes were not completed within the allotted class time.	_____
Results of the Conductor / Insulator Experiment	All of the results written on the graph were correct.	Up to 2 of the results written on the graph were incorrect.	3 to 4 of the results written on the graph were incorrect.	More than 4 of the results written on the graph were incorrect.	_____
Sharing/ Behavior The student was considerate to other group members by sharing test items and talking quietly throughout the experimentation.	**All** of the time	**Most** of the time	**Some** of the time	**None** of the time	_____
TOTAL POINTS					_____

Appendix K
Circuits/Insulators/Conductors

Name _____ Date _____

Write a capital T if you believe that the sentence is true. Write a capital F if you believe that the sentence is false or not true.

_____1. A conductor allows electricity to pass through it.

_____2. Metal is <u>not</u> a good conductor.

_____3. Plastic is a good insulator.

_____4. The thin wire inside a light bulb is a conductor.

_____5. The thin wire inside a light bulb is called the filament.

_____6. An eraser can be used as a conductor.

_____7. When electrons move quickly through a wire, a current is created.

_____8. Electricity creates motion in a light bulb.

_____9. Electricity creates sound in a radio.

_____10. When a switch is turned off, the circuit is closed.

Appendix L
Thomas Edison

Name _____ **Date** _____

Thomas Edison

Thomas Edison was a great _____. He invented the _____ _____ and many other things. But he didn't invent the light bulb _____. He had a _____ of other people helping him. First, Thomas Edison realized that there couldn't be _____ inside the glass bulb. Oxygen is the air that we breathe. Then his team had to find the right _____. This is the part that glows inside of a light bulb. It is a _____ because it allows electricity to pass through it. _____ became the first filament. Thomas Edison used _____ _____ for the insulator. Our world is a brighter place because of _____ _____.

Thomas Edison	thread	alone
filament	inventor	team
conductor	light bulb	oxygen

Appendix M
Poster Assessment

Name _____ **Date** _____

Electrical Safety Poster

Criteria	Points Below Average ⟷ Excellent				
Illustrations clearly depict one electrical safety rule.	1	2	3	4	5
Illustrations are neatly colored and reflect student's best effort.	1	2	3	4	5
The poster is clearly labeled with one electrical safety rule.	1	2	3	4	5
All text on the poster is legible and reflects the student's best effort.	1	2	3	4	5
All text on the poster is written with correct spelling and punctuation.	1	2	3	4	5

Total Points _____
25

Electricity Assessment

Name _____ **Date** _____

Multiple choice. Circle the correct answer.

1. What are all things made up of?

    a. water
    b. sand
    c. atoms

2. What would <u>not</u> be a good conductor of electricity?

    a. plastic
    b. metal
    c. water

3. What "jumps" from atoms, causing electricity to occur?

    a. protons
    b. electrons
    c. sparks

4. What is used inside of a generator to make electrons move out of their path, causing electricity to happen?

    a. nail
    b. compass
    c. magnet

5. Who invented the first electric light bulb?

    a. Thomas Edison
    b. George Washington
    c. Benjamin Franklin

Appendix N, pg. 2
Final Assessment

True or False

1. _____ Thomas Edison invented the electric light bulb on his first try.

2. _____ When a switch on a radio has been turned off, the circuit is closed.

3. _____ Conductors allow electricity to pass through them.

4. _____ You should never put anything into an outlet that is not an electrical plug.

5. _____ Static electricity is not able to travel in a circuit.

Use the words at the bottom of the page to complete the following sentences.

1. A _____ is the conductor used inside of a light bulb.

2. _____ is usually used as an insulator on electrical cords.

3. A large _____ inside of a power plant can supply electricity to a whole city.

4. When electrons begin to travel quickly through a conductor, a _____ is created.

5. A _____ produced a small amount of electricity for our electrical circuits.

Word Bank

battery	**plastic**
filament	**current**
generator	

Appendix N, pg. 3
Final Assessment

Answer the following questions:

1. What did you do to produce static electricity on the plastic comb? _____

_____

_____

2. Name four items that you used to create your electrical circuit.

   1. _____
   2. _____
   3. _____
   4. _____

3. List three items that you tested that were good conductors.

   1. _____
   2. _____
   3. _____

4. List three items that you tested that were insulators.

   1. _____
   2. _____
   3. _____

5. List two electrical safety rules.

   1. _____
   2. _____
   3. _____

Appendix O
Final Assessment Answer Key

Electricity Test Key

Multiple Choice:

1. (c) atoms
2. (a) plastic
3. (b) electrons
4. (c) magnet
5. (a) Thomas Edison

True or False:

1. False
2. False
3. True
4. True
5. True

Fill in the blank:

1. filament
2. plastic
3. generator
4. current
5. battery

Short answer questions:

1. Rubbing plastic wrap on the plastic comb produced static electricity.
2. a. aluminum foil
   b. battery
   c. flash light bulb
   d. paper clip
   e. rubber band
   f. brass fasteners
3. answers may vary
4. answers may vary
5. answers may vary