Energy, Electricity, Circuits, OH MY!

Grade Level: Grade 3
Content Area: Physical Science
Core Area: ENERGY TRANSFER – ELECTRICITY AND MAGNETISM

Lesson Overview: Using wires, switches, batteries, light bulbs, and propellers, students will create and differentiate between simple, series, and parallel circuits. They will also use their knowledge of circuits to engineer the “Incredible Writing Machine.”

2005 Standards Correlation:
Grade 4 Science
Properties of Light and Electricity
Standard 4-5: The student will demonstrate and understanding of the properties of light and electricity. (Physical Science)
Indicators:
5.5 Explain how electricity, as a form of energy, can be transformed into other forms of energy (including light, heat, and sound).
5.6 Summarize the functions of the components of complete circuits (including wire, switch, battery, and light bulb)
5.7 Illustrate the path of electric current in series and parallel circuits.
5.8 Classify materials as either conductors or insulators of electricity

2014 Standards Correlation:
Standard 3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.

3.P.3A. Conceptual Understanding: Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.

Performance Indicators: Students who demonstrate this understanding can:

3.P.3A.1 Obtain and communicate information to develop models showing how electrical energy can be transformed into other forms of energy (including motion, sound, heat, or light).
3.P.3A.2 Develop and use models to describe the path of an electric current in a complete simple circuit as it accomplishes a task (such as lighting a bulb or making a sound).
3.P.3A.3 Analyze and interpret data from observations and investigations to classify different materials as either an insulator or conductor of electricity.
**Materials:**
- Electric circuit demonstration board and 75 W bulbs
- Hula hoops with battery and bulbs illustrations with velcro
- String of Christmas lights (on a series circuit)
- Batteries (8 per group)
- Plastic battery holders (8 per group)
- Aluminum battery clips (16 per group)
- Test leads with alligator clips (12 per group)
- 1.5 v motors (4 per group)
- Propeller fans (4 per group)
- Bulbs (8 per group)
- Bulb sockets (8 per group)
- Switches (4 per group)
- Van de Graaff electrostatic generator

**Incredible Writing Machine:**
- 1.5 volt motors (one per group)
- Telephone wire or bell wire (four 6in pieces per group)
- C or D batteries (one per group)
- Pencils (one per group)
- Plastic Cups – 16 oz or larger (one per group)
- Rubber Bands – large width (two per group)
- Craft sticks or tongue depressors (two per group)
- Masking tape (available to each group)
- Rectangle erasers (one per group)
- Paper clips (two per group)
- Tooth picks (five per group)
- Brass Fasteners (two per group)

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### 7E Procedures for Circuit City lesson:

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<tr>
<th>ELICIT</th>
<th>What do the students know about electricity? Ask students to make the motor/propeller to turn using one battery and the motor</th>
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• Demonstrate the circuit board: show a simple circuit, series circuit, and parallel circuits. What do you think will happen if...?  
• Ask students to “draw” a simple circuit, series circuit, and parallel circuits with fingers in the air.  
• Ask for student volunteers to show the 3 types of circuits using hula hoops.  
• Show them a string of Christmas lights. What happens if one bulb goes out? (This is a series circuit) |
| EXPLORE | Ask the students to work together in teams to meet the following challenges. Allow about 25 minutes for this.  
1. Light one bulb in a simple circuit.  
2. Light two bulbs in a series circuit (use two batteries and two bulbs).  
3. Light 1 bulb and start 1 motor/fan using parallel circuits.  
4. Start a motor/fan using a switch.  
5. Try something new!  
For the “Try Something New” Challenge, you might suggest that students figure out a way to make their light bulb burn brighter, make their propeller spin faster or in the opposite direction, or insert a new conductor such as a paperclip or an earring. |
| EXPLAIN | Use the Powerpoint presentation to review concepts, introduce vocabulary, and discuss how the teams met the challenges. |
| ELABORATE | Have students apply their knowledge of circuitry, energy transfer, and the engineering design process by creating the “Incredible Writing Machine” |
| EVALUATE | Draw a diagram illustrating the 3 types of circuits and their components. |
| EXTEND | Explain the difference between static electricity and current electricity. Static electricity jumps while current electricity flows. Do a hair-raising demonstration using the Van de Graaff electrostatic generator. |
The Incredible Writing Machine

Objective: To apply knowledge of energy, circuits, conductors, insulators and the engineering design process.

SC Standards Correlation: 3rd Grade: Standard 3.P.3
Conceptual Understanding ____________
Performance Indicator ____________________

Materials: 1.5 volt motors (one per group)
Telephone wire or bell wire (four 6in pieces per group)
C or D batteries (one per group)
Pencils (one per group)
Plastic Cups – 16 oz or larger (one per group)
Rubber Bands – large width (two per group)
Craft sticks or tongue depressors (two per group)
Masking tape (available to each group)
Rectangle erasers (one per group)
Paper clips (two per group)
Tooth picks (five per group)
Brass Fasteners (two per group)

Procedure:
- Place the above noted items inside the plastic cup.
- Explain to the class that their engineering challenge is to use the items in the cup (including the cup if necessary) to design a writing machine that will write anything on paper without any human assistance (no holding cup in place).
- Adjust the challenge to include the following (if students have learned about switches and conductors and insulators):
  - Must contain a switch to turn it off and on
- Encourage students to follow the engineering design Process.
- Allow enough time for each group to design a solution to the challenge.
- Remember there is may be more than one right answer.
- Allow groups to present their design to the class for discussion