# PBL Unit: SOL 4.3 Electricity
**Duration:** 3 weeks

**Grade Level:** 4th grade  
**Local Partners:** Dominion Energy

<table>
<thead>
<tr>
<th>Theme (Science Topic)</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem</strong> (Real scientific problem with multiple solutions stated as a question that will be solved over time)</td>
<td>How can we determine the most efficient source of electricity for our school district?</td>
</tr>
<tr>
<td><strong>Student Roles</strong> (Authentic scientist roles for students)</td>
<td>S.E.E.S. (Student Electrical Engineers)</td>
</tr>
<tr>
<td><strong>Scenario</strong> (Real situation and setting that is interesting and plausible)</td>
<td>The School Board is concerned with the skyrocketing electricity bill. Unless, NPS can find a way to reduce the use of electrical energy, all extracurricular activities and events are in danger. Your job is to create and design possible solutions to this problem.</td>
</tr>
</tbody>
</table>
| **Resources** (Identify and evaluate likely places students will seek information to solve the problem - internet, books, expert) | Dominion Energy Representative  
Magic School Bus Gets Energized!  
Science Fusion – Unit 9: Energy and Unit 10: Electricity |
| **Culminating Project/Assessment** (Develop a final project that poses a solution) | S.E.E.S. agents will present their solutions to the problem in a variety of ways (models, posters, etc.) to Dr. Boone and the NPS School Board. |
| **Safety** (Identify safety issues that might arise as students gather information) | • Electric shock  
• Burns  
• Cuts |
How can we determine the most efficient source of electricity for our school district?

What is electricity?

What are conductors and insulators?

What are electrical circuits?

What is the difference between open and closed circuits?

How is electricity generated?

What are the major sources of electrical power in Virginia?

How does electricity get from the source to destination (our schools)?

What other sources of energy are available in Virginia?

What are fossil fuels, renewable energy, and solar power?

How can we use fossil fuels, renewable energy, and solar power?

How can different forms of energy be transformed?

What source of energy does NPS currently use?

What are the current costs of NPS' current energy source?

How much energy is being used with this source? Is the source energy efficient?

What are the major sources of electrical power in Virginia?

What are fossil fuels, renewable energy, and solar power?

What are the more efficient energy sources available to NPS?

What are the major sources of electrical power in Virginia?
PBL Unit: SOL 4.3 Electricity
Duration: 3 weeks

Lesson 1: Introduction Students will be introduced to the scenario via letter or visit from Superintendent Boone. Students will start the Batteries Included Lesson-Energy Balls (Engage)

Lesson 2: Batteries Bulbs, and Wires and Electrical Circuits Read Aloud(Explore and Explain)- Students will explore electrical circuits. Students will use the given materials to show all the ways they can make a light a bulb. After completing a Cloze paragraph on electricity, students will use their batteries, bulbs, wires, and metal paper clips to show their understanding of the words from the cloze activity.

Lesson 3-4: Too Many Toys Read Aloud and Toy Take Apart Lab- Following a read aloud of Too Many Toys by David Shannon, students will take apart some simple battery-operated children’s toys to see what's inside and how they work.

Lesson 5-6: Flick a Switch-Students will complete activities that focus on how electricity gets to our homes, the reasons electricity should be conserved, and practical ways that we can use energy wisely.

Lesson 7: Renewable Energy- A speaker from Dominion Energy will explain renewable energy sources that generate electricity, such as wind and solar to the students. Students will learn about the growing role that renewables will play in the future.

Lesson 8: The Boy Who Harnessed the Wind- The teacher will read aloud, The Boy Who Harnessed the Wind by William Kamkwamba and Bryan Mealer and view the 6 minute documentary Moving Windmills. Students will then complete What's in William’s Windmill? Preassessment.

Lesson 9: Dynamo Torch, Dynamo Challenge, and Inside the Dynamo- Students will explore the Dynamo Torch and how it generates energy.

Lesson 10: How is the Dynamo Torch Like William’s Windmill?: Students will compare and contrast William's Windmill and the Dynamo Torch. Students will create a T-chart or Venn diagram to display their findings. Students will then complete the close reading, “Energy Gets Things Done.”


Lesson 12- Energy Resources- Students will discuss the advantages and disadvantages of using wind energy. Students will also review the difference between renewable and non-renewable resources.
Lesson 13- Waterwheel Work- Students will learn the history of the waterwheel and common uses for water turbines today. They will explore kinetic energy by creating their own experimental waterwheel from a two-liter plastic bottle. They will investigate the transformations of energy involved in turning the blades of a hydro-turbine into work, and experiment with how weight affects the rotational rate of the waterwheel. Students will also discuss and explore the characteristics of hydroelectric plants. (https://www.teachengineering.org/activities/view/cub_energy2_lesson08_activity2)

Lesson 14-15- Solar Energy Engineering Project: Light Transferred to Electric Energy- Students will work through the engineering design process to research, plan, and build a solar powered car to race.

Lesson 16-Energy Resources Poster/Presentations- Students will work in teams to research an energy resource and create a presentation about the resource and present it to the NPS school board.

SWIRL PBL Lesson

Date: Day 1

SOL Content Standard(s):
SOL 4.1- The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
a) distinctions are made among observations, conclusions, inferences, and predictions;
b) objects or events are classified and arranged according to characteristics or properties;
c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
d) appropriate instruments are selected and used to measure elapsed time;
e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
f) independent and dependent variables are identified;
g) constants in an experimental situation are identified;
h) hypotheses are developed as cause and effect relationships;
i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
j) numerical data that are contradictory or unusual in experimental results are recognized;
k) data are communicated with simple graphs, pictures, written statements, and numbers;
l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
m) current applications are used to reinforce science concepts.
**SOL 4.3**- The student will investigate and understand the characteristics of electricity. Key concepts include

a) conductors and insulators;

b) basic circuits;

c) static electricity;

d) the ability of electrical energy to be transformed into light and motion, and to produce heat;

e) simple electromagnets and magnetism; and

f) historical contributions in understanding electricity.

**Level 1 Question:** How can we determine the most efficient source of electricity for our school district?

**Level 2 Question:** What is electricity?

**Level 3 Question(s):** What are conductors and insulators?  
What are electrical circuits?

**Student Objective(s):**  
By the end of this lesson, students will be able to illuminate a flashlight bulb using wires and batteries and demonstrate an open and closed circuit.

**NOS tenets:**

- Science demands evidence.
- Scientific ideas are durable yet subject to change.
- Science uses a blend of logic and imagination.
- Science is a social activity.
- Scientists attempt to avoid bias.
- Scientific knowledge is the product of observation and inference.
- Scientific laws and theories are different kinds of scientific knowledge.
- Scientists use many methods to develop scientific knowledge. (models, journals, engineering)

**Day 1 Activities:**

[Image]
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Description</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Letter from Superintendent</strong></td>
<td>Letter</td>
</tr>
<tr>
<td></td>
<td><strong>Engage Activity:</strong></td>
<td><strong>Explore/Explain Activity:</strong></td>
</tr>
<tr>
<td></td>
<td>- Examine the energy balls and have students draw what they think will be inside the energy ball on the student page.</td>
<td>- D Batteries - 2 insulated copper wires - Flashlight bulbs - Roll of masking tape - Electrical</td>
</tr>
<tr>
<td></td>
<td><strong>Journal Question:</strong></td>
<td><strong>Explore/Explain Activity:</strong></td>
</tr>
<tr>
<td></td>
<td>- What is electricity? - What are renewable resources available to us? - How much energy will we need to produce to power NPS?</td>
<td>- Small shocks - Poke themselves with the wire - Cut themselves on broken bulbs</td>
</tr>
<tr>
<td></td>
<td><strong>Engage Activity:</strong></td>
<td><strong>Anticipated Student Response</strong></td>
</tr>
<tr>
<td></td>
<td>- Touch one of the metal pieces with the one finger? - Touch both metal pieces with the same hand? Why? - Put one finger on one of the metal pieces and another finger on the plastic? - Touch both metal pieces with your index finger? Why? - Touch one finger to one of the metal pieces and have your partner touch the other one? - Join hands with that person while keeping your fingers on the metal pieces? Why? - Try adding people to your circle? Why? - Predict whether or not the energy ball will light if the whole class holds hands? Why?</td>
<td>1. Answers will vary 2. Missing a power source 3. Answers will vary 4. Answers will vary 5. You have to be touching the positive and negative ends of the battery with the wire or bulb. One wire on the side of the bulb and</td>
</tr>
<tr>
<td></td>
<td><strong>Explore/Explain Activity:</strong></td>
<td><strong>Misconception to Address</strong></td>
</tr>
<tr>
<td></td>
<td>- Is it possible to light a bulb with just wires? - Why is the bulb not lighting? - What is missing? - Is it possible to light a bulb with just a battery and two wires?</td>
<td>- None</td>
</tr>
<tr>
<td></td>
<td><strong>Journal:</strong></td>
<td><strong>Engage Activity:</strong></td>
</tr>
<tr>
<td></td>
<td>- Nothing - Lights up and makes a sound - Nothing - Lights up and makes a sound - Nothing - Lights up and makes a sound - Lights up and makes a sound</td>
<td>1. Nothing 2. Lights up and makes a sound 3. Nothing 4. Lights up and makes a sound 5. Nothing 6. Lights up and makes a sound 7. Lights up and makes a sound 8. Lights up and makes a sound</td>
</tr>
</tbody>
</table>
Dear Student Electrical Engineers,

It is with great despair that I write this letter. Norfolk Public Schools is faced with a major dilemma. Our district’s electricity bill has increased steadily for several years. This past school year the electricity bill skyrocketed to an all-time high. Due to the recent budget cuts, we are struggling to pay this bill. Our massive electricity bill has put the district in a state of financial turmoil.

After weighing several options, the School Board is considering the difficult decision to eliminate all extracurricular activities to cover the expense. This would affect all sporting teams and events, the Science Fair, PTA meetings, concerts, and afterschool clubs and tutoring.

We realize these programs are important and valuable to the students of NPS. S.E.E.S. agents, that’s why I am enlisting your help to save our programs. It is your task to find a way to reduce the electrical energy in Norfolk Public Schools. As part of your assignment, you will work collectively to develop a strong understanding of electricity, explore the current source of NPS energy, and research other sources of energy that are available and cost effective in Virginia. I am confident that by putting on your thinking caps and working together as a team, you will be able to assist in finding a solution to this problem. You will present your findings in three weeks at the next school board meeting.

Please review and sign your job contracts. If you have any questions, please consult your Teacher Electrical Engineer (T.E.E.) as she reviews the contract with you. Your T.E.E. will be available daily to guide your research and understanding of energy sources.

Thank you for volunteering to help our worthy cause. I am confident that you will find a solution to our issue. I look forward to your presentations. I will be checking in on your progress as you complete your mission.

Sincerely,

Dr. Melinda J. Boone,
Superintendent of Norfolk Public Schools
| What have you learned about electricity today? -How did we use the Nature of Science? | Science notebooks | 4. Is it possible to light the bulb with just one wire? 5. What are all the things that must happen for the bulb to light? 6. Add a second battery? | the other on the bottom, etc. |

**Strategies for SPED and ELL Modification and Differentiation:**

**Check for Understanding:**

**SWIRL PBL Lesson Plan**

**Date:** Day 2

**SOL Content Standard(s):**

**SOL 4.1**- The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- a) distinctions are made among observations, conclusions, inferences, and predictions;
- b) objects or events are classified and arranged according to characteristics or properties;
- c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
- d) appropriate instruments are selected and used to measure elapsed time;
- e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
- f) independent and dependent variables are identified;
- g) constants in an experimental situation are identified;
- h) hypotheses are developed as cause and effect relationships;
- i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
- j) numerical data that are contradictory or unusual in experimental results are recognized;
- k) data are communicated with simple graphs, pictures, written statements, and numbers;
- l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
- m) current applications are used to reinforce science concepts.

**SOL 4.3**- The student will investigate and understand the characteristics of electricity. Key concepts include

- a) conductors and insulators;
b) basic circuits;
c) static electricity;
d) the ability of electrical energy to be transformed into light and motion, and to produce heat;
e) simple electromagnets and magnetism; and
f) historical contributions in understanding electricity.

Level 1 Question: How can we determine the most efficient source of electricity for our school district?

Level 2 Question: What is electricity?

Level 3 Question(s): What are conductors and insulators?
What are electrical circuits?

Student Objective(s):
By the end of this lesson, students will be able to

NOS tenets:
- Science demands evidence.
- Scientific ideas are durable yet subject to change.
- Science uses a blend of logic and imagination.
- Science is a social activity.
- Scientists attempt to avoid bias.
- Scientific knowledge is the product of observation and inference.
- Scientific laws and theories are different kinds of scientific knowledge.
- Scientists use many methods to develop scientific knowledge. (models, journals, engineering)

Day 2 Activities:

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Description</th>
<th>Materials</th>
<th>Guiding Questions (Teacher talk)</th>
<th>Anticipated Student Response</th>
<th>Safety Concerns</th>
<th>Misconceptions to Address</th>
</tr>
</thead>
</table>

[No Image Provided]
insert in “Electrical Circuits”
- Complete the student page – Cloze paragraph.

Electrical Circuits Student Page (Cloze)

3. Add a switch using a paper clip, then close it.
4. What parts of your circuit are conductors?
5. What parts of your circuit are insulators?
6. What part of your circuit stores chemical energy?
7. Have your ideas changed about what you think might be inside the energy ball?

3. Demonstration
4. Wires, metal on bulb, battery, switch
5. Plastic coating on wires, masking tape
6. Battery
7. Answers will vary

- Pokes with wire or paper clips
- Cuts from broken bulbs

Journal Question:
- What did you learn about circuits today that will be of use in wiring our school building?
- How did we use the nature of science today?

Strategies for SPED and ELL Modification and Differentiation:

Check for Understanding: Cloze paragraph

SWIRL PBL Lesson Plan

Date: Day 3

SOL Content Standard(s):
SOL 4.1- The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
a) distinctions are made among observations, conclusions, inferences, and predictions;
b) objects or events are classified and arranged according to characteristics or properties;
c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
d) appropriate instruments are selected and used to measure elapsed time;
e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
f) independent and dependent variables are identified;
g) constants in an experimental situation are identified;
h) hypotheses are developed as cause and effect relationships;
i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
j) numerical data that are contradictory or unusual in experimental results are recognized;
k) data are communicated with simple graphs, pictures, written statements, and numbers;
l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
m) current applications are used to reinforce science concepts.

SOL 4.3-The student will investigate and understand the characteristics of electricity. Key concepts include
   a) conductors and insulators;
   b) basic circuits;
   c) static electricity;
   d) the ability of electrical energy to be transformed into light and motion, and to produce heat;
   e) simple electromagnets and magnetism; and
   f) historical contributions in understanding electricity.

Level 1 Question: How can we determine the most efficient source of electricity for our school district?

Level 2 Question: What is electricity?

Level 3 Question(s): What are conductors and insulators?
   What are electrical circuits?

Student Objective(s):
By the end of this lesson, students will be able to

NOS tenets:
- Science demands evidence.
- Scientific ideas are durable yet subject to change.
- Science uses a blend of logic and imagination.
- Science is a social activity.
- Scientists attempt to avoid bias.
- Scientific knowledge is the product of observation and inference.
- Scientific laws and theories are different kinds of scientific knowledge.
- Scientists use many methods to develop scientific knowledge. (models, journals, engineering)

### Day 3 Activities:

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Description</th>
<th>Materials</th>
<th>Guiding Questions (Teacher talk)</th>
<th>Anticipated Student Response</th>
<th>Safety Concerns</th>
<th>Misconceptions to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Elaborate Activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Read Aloud</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Too Many Toys”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Toy Take-Apart Lab</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Elaborate Activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Too Many Toys” book</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Toy Take-Apart Letter (send home)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Toy Take-Apart Letter (send home)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Toy Take-Apart Lab</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- small screwdrivers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- battery operated toys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Operation Game</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Elaborate Activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Has anyone ever read the book No, David, or any other book by David Shannon?</td>
<td></td>
<td>1. Yes or No (that could be followed by the books they have read by David Shannon)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. What were some favorite toys you played with when you were little?</td>
<td></td>
<td>2. Answers will vary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Did you have any toys that had lights, sounds, or moved?</td>
<td></td>
<td>3. Yes or no. Students by name and describe the toy. Answers will vary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Did Spencer have any toys that had lights, sounds, or moved?</td>
<td></td>
<td>4. Robotic dog, talking books, and video games</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. How do you think Spencer’s toys are powered?</td>
<td></td>
<td>5. Batteries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Have you ever thought about what</td>
<td></td>
<td>6. Yes or No, followed by an explanation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Elaborate Activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Yes or No (that could be followed by the books they have read by David Shannon)</td>
<td></td>
<td>7. Yes or No. Responses will vary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Answers will vary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Yes or no. Students by name and describe the toy. Answers will vary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Robotic dog, talking books, and video games</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Batteries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Yes or No, followed by an explanation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Yes or No. Responses will vary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Elaborate Activity: Students should wear safety goggles  
- cut skin from sharp objects  
- Supervised use of screwdrivers
might be inside those kinds of toys?
7. Wouldn’t it be fun and interesting to find out what’s inside of the toys?

Strategies for SPED and ELL Modification and Differentiation:

Check for Understanding: Student Discourse – Thought Swap
Checkpoint Lab A, B, & C

SWIRL PBL Lesson Plan

Date: Day 4

SOL Content Standard(s):
SOL 4.1- The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
a) distinctions are made among observations, conclusions, inferences, and predictions;
b) objects or events are classified and arranged according to characteristics or properties;
c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
d) appropriate instruments are selected and used to measure elapsed time;
e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
f) independent and dependent variables are identified;
g) constants in an experimental situation are identified;
h) hypotheses are developed as cause and effect relationships;
i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
j) numerical data that are contradictory or unusual in experimental results are recognized;
k) data are communicated with simple graphs, pictures, written statements, and numbers;
l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
m) current applications are used to reinforce science concepts.
SOL 4.3- The student will investigate and understand the characteristics of electricity. Key concepts include
a) conductors and insulators;
b) basic circuits;
c) static electricity;
d) the ability of electrical energy to be transformed into light and motion, and to produce heat;
e) simple electromagnets and magnetism; and
f) historical contributions in understanding electricity.

**Level 1 Question:** How can we determine the most efficient source of electricity for our school district?

**Level 2 Question:** What is electricity?

**Level 3 Question(s):** What are conductors and insulators? What are electrical circuits?

**Student Objective(s):**
By the end of this lesson, students will be able to

**NOS tenets:**
- Science demands evidence.
- Scientific ideas are durable yet subject to change.
- Science uses a blend of logic and imagination.
- Science is a social activity.
- Scientists attempt to avoid bias.
- Scientific knowledge is the product of observation and inference.
- Scientific laws and theories are different kinds of scientific knowledge.
- Scientists use many methods to develop scientific knowledge. (models, journals, engineering)

**Day 4 Activities:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Description</th>
<th>Materials</th>
<th>Guiding Questions (Teacher talk)</th>
<th>Anticipated Student Response</th>
<th>Safety Concerns</th>
<th>Misconceptions to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elaborate Activity:</td>
<td>Elaborate Activity:</td>
<td>Students will complete the Toy Take-Apart Lab</td>
<td>Elaborate Activity:</td>
<td>Elaborate Activity:</td>
<td>- Students should wear safety goggles</td>
<td></td>
</tr>
</tbody>
</table>
- Complete Toy Take-Apart Checkpoint Lab student sheets A, B, & C.
- Toy Take-Apart Letter Lab
- Toy Take-Apart Checkpoint Lab student sheets A, B, & C.
- small screwdrivers

**Evaluate Activity:**
- Batteries and bulbs quiz

**Evaluate Activity:**
- Batteries and bulbs quiz

and complete the Checkpoint Lab Sheets A, B, & C.

Teacher will have students share what they wrote on Checkpoint Lab C.

Students will complete the Batteries and Bulbs Quiz.

Answers will vary based on the toys student choose

- cut skin on sharp objects
- Supervised use of screwdrivers

---

**Strategies for SPED and ELL Modification and Differentiation:**

**Check for Understanding:** Discourse – Thought Swap
Batteries and Bulb Quiz

---

**SWIRL PBL Lesson Plan**

**Date:** Days 5-6

**SOL Content Standard(s):**

SOL 4.1- The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a) distinctions are made among observations, conclusions, inferences, and predictions;
b) objects or events are classified and arranged according to characteristics or properties;
c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
d) appropriate instruments are selected and used to measure elapsed time;
e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;  
f) independent and dependent variables are identified;  
g) constants in an experimental situation are identified;  
h) hypotheses are developed as cause and effect relationships;  
i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;  
j) numerical data that are contradictory or unusual in experimental results are recognized;  
k) data are communicated with simple graphs, pictures, written statements, and numbers;  
l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and  
m) current applications are used to reinforce science concepts.

SOL 4.3- The student will investigate and understand the characteristics of electricity. Key concepts include  
a) conductors and insulators;  
b) basic circuits;  
c) static electricity;  
d) the ability of electrical energy to be transformed into light and motion, and to produce heat;  
e) simple electromagnets and magnetism; and  
f) historical contributions in understanding electricity.

Level 1 Question: How can we determine the most efficient source of electricity for our school district?  

Level 2 Question: What is electricity?  

Level 3 Question(s): What are conductors and insulators?  
What are electrical circuits?  

Student Objective(s):  
By the end of this lesson, students will be able to

NOS tenets:  
- Science demands evidence.  
- Scientific ideas are durable yet subject to change.  
- Science uses a blend of logic and imagination.  
- Science is a social activity.  
- Scientists attempt to avoid bias.
- Scientific knowledge is the product of observation and inference.
- Scientific laws and theories are different kinds of scientific knowledge.
- Scientists use many methods to develop scientific knowledge. (models, journals, engineering)

### Day 5-6 Activities:

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Description</th>
<th>Materials</th>
<th>Guiding Questions (Teacher talk)</th>
<th>Anticipated Student Response</th>
<th>Safety Concerns</th>
<th>Misconceptions to Address</th>
</tr>
</thead>
</table>
| Day 5 | **Engage Activity:** - Where Does Electricity Come From?     | Engage Activity: Teaching Science Through Trade Books: Chapter 21- Flick a Switch (to be used through the entire lesson) | **Engage Activity:** -Where does electricity in your home come from?  
- How does it get there?  
- What does it cost?  
- How is your household electricity measured?  | **Engage Activity:** -answers will vary  
-switch, light bulb, plug, power lines (answers will vary)  
- Answers will vary  
-by the electricity company, I don’t know (answers will vary)  | none | none |
|       | **Explore Activity:** Students will complete the Electricity at Home take-home page (p. 112) in their journals | **Explore Activity:** Electricity at Home take-home page | **Explore Activity:** Give students a copy of the Electricity at Home take-home page (p. 112), which asks students to make observations of their electric meter, find out the name of their electric company, investigate the different ways their families use electricity, and imagine what a day would be like without electricity. Students will share their | **Explore Activity:** -Answers will vary  
- (Students may describe or draw the meter)  
- All students will answer Dominion Energy for electric company  
- Ways electricity is used by families would include lights, television, stove, microwave, refrigerator, video games, cell phones, air conditioning, heater (answers will vary)  | none | none |
|       | **Engage Activity:** - Where does electricity in your home come from?  
- How does it get there?  
- What does it cost?  
- How is your household electricity measured?  | | | | | |
|       | **Engage Activity:** -switch, light bulb, plug, power lines (answers will vary)  
- Answers will vary  
-by the electricity company, I don’t know (answers will vary)  | | | | | |
|       | **Explore Activity:** -Answers will vary  
- (Students may describe or draw the meter)  
- All students will answer Dominion Energy for electric company  
- Ways electricity is used by families would include lights, television, stove, microwave, refrigerator, video games, cell phones, air conditioning, heater (answers will vary)  | | | | | |
|       | | | | | | |
### Day 6

**Explain Activity:**
Students will find out more about electricity and how power plants produce electricity.

**Elaborate Activity:**
The teacher will review the benefits of conserving energy and electricity.

**Elaborate Activity:**
- Flick a Switch: How Electricity Gets to Your Home by Barbara Seuling
- Let’s Learn About Electricity Anticipation Guide p. 114

**Elaborate Activity:**

**Explain Activity:**
- Before Reading:
- Give students Let’s Learn About Electricity Anticipation Guide and have them fill out the before column.
- Introduce the author and illustrator of Flick a Switch: How Electricity Gets to Your Home.

**During Reading:**
The teacher will read Flick a Switch to the students. As the teacher reads aloud, the students will signal as they hear answers to the True/False statements from the anticipation guide.

**After Reading:**
Ask students to fill out the After reading column of the anticipation guide and discuss the correct answers. Then turn back to pages 14-15, which explain how

- Answers will vary
Power plants produce electricity from various resources. Challenge students to find out how the electricity used in their own homes is generated. Ask, “How is electricity generated in your own home?”

**Elaborate Activity:**
Students will visit the website to watch public service announcements featuring kids, and play games. This website also features ideas and activities that will foster student understanding of energy conservation.

**Strategies for SPED and ELL Modification and Differentiation:**

**Check for Understanding:** Let’s Learn About Electricity Anticipation Guide