Sample Lesson
Big Ideas
Unit Summary

Lesson 6: Identifying Conductors and Insulators
Teacher Background Information
My Science Notebook
Mi Libreta de Apuntes de Ciencias
Assessments
Teacher Masters
Visual Pack
ExploraGear
I Wonder Circle

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Module Components
Full Curriculum List
Science Companion Unique Features
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Science Companion
The Teacher Lesson Manual engages and guides teachers to implement hands-on science lessons with their students. Lesson by lesson, students develop strong process skills and in-depth understanding of specific concepts.

The book brings teachers up to speed for the science content through “Teacher Background Information” and in-context lesson notes. Teachers can feel comfortable with leading the class—whether they have a long history of teaching science or not.

Each Teacher Lesson Manual focuses on a set of Big Ideas for a science topic. Each lesson focuses on a Big Idea. Groups of lessons (called clusters) develop a Big Idea through a series of different experiences and discussions.

Lessons Follow a Consistent Sequence

🌟 Engage – In this section of a lesson, the teacher introduces the topic. The goal is to briefly generate interest, activate prior knowledge, or link the day’s activities to what has come before.

🌟 Explore – This is often (but not always) a hands-on exploration conducted in small groups. Students record their work in their Science Notebooks. Collaboration with peers is encouraged. Key materials are provided in the ExploraGear kit.

🌟 Reflect and Discuss – In this important section, the teacher and students discuss what they observed, share ideas and data, and reflect on the day’s activities. This portion of the lesson brings the class back to the Big Idea.

You’ll find that while the lesson format is very consistent, students explore science content and the process of “doing science” in a large variety of ways.

You’ll also find that students LOVE the mix of active, hands-on, minds-on science.
Lessons at a Glance

Electrical Circuits Unit Overview
The Electrical Circuits Unit introduces students to the basics of electricity. Through a variety of explorations, students observe, describe, and investigate static electricity and low-voltage current electricity. They test their ideas on how to light a bulb. They further investigate circuits that produce motion, sound, and magnetic effects. They explore everyday materials and classify them as either conductors or insulators of electricity. And finally, they wrap up their studies by recognizing electrical hazards and the safe use of electricity.

Science Content: Big Ideas
The Electrical Circuits Unit concentrates on the following Big Ideas. Along with the scientific Habits of Mind discussed on pages 6-7, these concepts are reinforced throughout the unit. The lessons in which each Big Idea is introduced or is a major focus are indicated in parentheses.

• Electrically charged objects attract or repel other objects. (Lessons 1-2)
• For an electric current to flow, there must be a complete path or loop for it to follow around a circuit and return to its source. (Lessons 3-5)
• The flow of electric current can produce light, heat, sound, motion, or magnetic effects. (Lesson 5)
• Some materials allow electric current to flow more easily than others. (Lessons 6-7)
• It is important to avoid electrical hazards by using electricity safely. (Lesson 7)
## Unit Summary

<table>
<thead>
<tr>
<th>Cluster 1: Static Electricity Lessons 1–2</th>
<th>Cluster 2: Current Electricity Lessons 3–7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overview</strong></td>
<td>Students observe static electricity and the interactions of charged objects. They charge objects by rubbing them with selected materials, and test the effects of charge on a wide variety of materials.</td>
</tr>
<tr>
<td><strong>Science Content</strong></td>
<td>• Electrically charged objects attract or repel other objects.</td>
</tr>
<tr>
<td></td>
<td>• Conduct open-ended explorations of static charge with materials from the lessons, and newly added materials.</td>
</tr>
<tr>
<td></td>
<td>• Provide books about electricity to support independent reading.</td>
</tr>
<tr>
<td></td>
<td>• Model attraction and repulsion.</td>
</tr>
<tr>
<td></td>
<td>• Observe the effect charged objects have on flowing water and crumbled paper.</td>
</tr>
<tr>
<td></td>
<td>• Investigate types of natural electricity.</td>
</tr>
<tr>
<td></td>
<td>• Look for things that use batteries at home.</td>
</tr>
<tr>
<td></td>
<td>• Conduct a home inspection to look for possible electrical hazards.</td>
</tr>
<tr>
<td><strong>Family Links</strong></td>
<td>• Make a wet cell battery.</td>
</tr>
<tr>
<td><strong>Further Science Explorations</strong></td>
<td>• Compare batteries to outlets.</td>
</tr>
<tr>
<td></td>
<td>• Investigate the conductivity of a salt-water solution.</td>
</tr>
<tr>
<td></td>
<td>• Social Studies: Create a display of people and events in history related to electricity.</td>
</tr>
<tr>
<td><strong>Cross-Curricular Extensions</strong></td>
<td><strong>Social Studies</strong>: Add to the display of people and events in history related to electricity.</td>
</tr>
</tbody>
</table>
Big Idea
Some materials allow electric current to flow more easily than others.

Process Skills
- Predicting
- Recording
- Comparing and contrasting
- Following directions

Overview
In this lesson, students identify and classify objects and materials as either conductors or insulators of electricity. After predicting whether an object will conduct electric current, they use a bulb and battery circuit as a tester. They record their results, and then find a pattern in the types of materials that work as conductors. Finally, they apply their knowledge of the materials to evaluating the design of a light bulb, extension cord, and an electrician’s glove.

Key Notes
- Assemble collections of small objects that work as conductors and insulators. See the preparation section for suggestions.
- This lesson requires three 15 cm (6 in) lengths of insulated wire for each group. Count how many remain from Lesson 4, then cut additional wires as needed and strip insulation from the ends.
- For more information about the science content in this lesson, see the “Current Electricity” section of the Teacher Background Information on page 118.
Standards and Benchmarks

By examining materials that conduct electric current, students continue to meet Physical Science Standard B (Light, Heat, Electricity, and Magnetism): “Electrical circuits require a complete loop through which an electrical current can pass.”

As students consider insulating materials they might use to design an electrician’s glove, they also gain experience with The Nature of Technology Benchmark 3B (Designs and Systems): “Designs that are best in one respect (safety or ease of use, for example) may be inferior in other ways (cost or appearance).”

Lesson Goals

- Identify conductors and insulators.
- Recognize that most metals allow electric current to flow easily.

Assessment Options

- Listen to students’ responses during the reflective discussion, and review pages 17-19 in students’ science notebooks to assess their understanding of what materials make good conductors and insulators. Use criterion C on Rubric 2 as you record your evaluations.
- This lesson also provides another opportunity to assess students’ skills with making predictions. You can use the Predicting checklist to note their progress.
Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ExploraGear</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery, D-cell, alkaline</td>
<td>1 per group</td>
<td>To use with light bulb and wire.</td>
</tr>
<tr>
<td>Bulb holders</td>
<td>1 per group</td>
<td>To hold bulb and ends of two wires</td>
</tr>
<tr>
<td>Light bulbs, 2.5 V, #14</td>
<td>1 per group</td>
<td>To put in bulb holder.</td>
</tr>
<tr>
<td>Wire, 22-gauge, insulated copper</td>
<td>3 15-cm (6 in) lengths per group</td>
<td>To make tester with.</td>
</tr>
<tr>
<td><strong>Classroom Supplies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductors</td>
<td>4 per group</td>
<td>For students to test. Place in a resealable plastic bag with four insulators. See step 2 in preparation.</td>
</tr>
<tr>
<td>Electrical tape</td>
<td>2 pieces per group</td>
<td>To secure wires to D-cell batteries.</td>
</tr>
<tr>
<td>Insulators</td>
<td>4 per group</td>
<td>For students to test. Place in a resealable plastic bag with four insulators. See step 2 in preparation.</td>
</tr>
<tr>
<td>Overhead projector</td>
<td>1</td>
<td>To show overhead transparencies during reflective discussion.</td>
</tr>
<tr>
<td>Resealable plastic bags</td>
<td>1 per group</td>
<td>To hold collection of conductors and insulators.</td>
</tr>
</tbody>
</table>

Previous Lesson

- Overhead Transparency “Inside a Light Bulb” From Lesson 4
- Overhead Transparency “Inside an Extension Cord” From Lesson 4

Curriculum Items

- Overhead Transparency “Identifying Conductors and Insulators”
- Electrical Circuits Science Notebook, pages 15-19
- Rubric 2: Current Electricity (optional)
- Checklist: Predicting (optional)

**Preparation**

- Cut and strip the ends of extra wires for each group. In the explorations students need to use three wires for their bulb and battery circuit.

- Check to make sure that all batteries and bulbs are still working.

- Collect four conductors and four insulators for each group, and place each collection in a resealable plastic bag. Objects and materials you might choose include:
### Conductors and Insulators

<table>
<thead>
<tr>
<th>Conductors</th>
<th>Insulators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum foil squares</td>
<td>Cardboard squares</td>
</tr>
<tr>
<td>Paper clips</td>
<td>Wood toothpicks</td>
</tr>
<tr>
<td>Nickels</td>
<td>Erasers</td>
</tr>
<tr>
<td>Pennies</td>
<td>Rubber bands</td>
</tr>
<tr>
<td>Keys</td>
<td>Drinking straws</td>
</tr>
<tr>
<td>Bolts or nails</td>
<td>Glass marbles</td>
</tr>
<tr>
<td>Brass paper fasteners (brads)</td>
<td>Packing foam peanuts</td>
</tr>
<tr>
<td>Bottle caps</td>
<td>Pieces of chalk</td>
</tr>
<tr>
<td>Bobby pins</td>
<td>Corks</td>
</tr>
<tr>
<td>Uninsulated copper wire</td>
<td>String or twine</td>
</tr>
<tr>
<td>Metal pens</td>
<td>Plastic pens</td>
</tr>
</tbody>
</table>

**Teacher Note:** When selecting conductive items, look for thick and short objects. They conduct electricity better than thin or long objects made from the same material.

- Locate the Overhead Transparency “Identifying Conductors and Insulators.” In the first column, list the objects you put in the bags for testing.

**Vocabulary**

- **Conductor** . . . . . . A material that electric current goes through easily.
- **Insulator** . . . . . . A material electric current cannot go through easily.

### Teaching the Lesson

#### Engage

**Introductory Discussion**

1. Review what students learned in the previous three lessons about electric current. For example, ask:
   - What objects does someone need to build a simple electric circuit? (*A source of electricity, such as a D-cell battery; wire; and a receiver, such as a bulb, motor, or buzzer.*)
   - What makes a complete, or closed, circuit? (*The source, wire, and receiver are all connected in a complete loop.*)
• How do they know when electric current is flowing through a circuit? (It makes a bulb light, a motor turn, or a buzzer sound.)

2. Ask the class whether they could build an electric circuit using any object or material. Do they think they could complete a circuit with cotton string instead of metal wire? Why or why not?

3. Note that an electric circuit can only be made with objects or materials that an electric current can flow through. Explain that today they are going to investigate what objects and materials can or cannot be used to complete a circuit, then figure out whether to classify the object or material as one of two types:
   • **Conductor**—Electric current can flow through easily
   • **Insulator**—Electric current cannot flow through easily

**Teacher Note:** The ability of different materials to conduct electricity varies from very good (copper) to very poor (glass). However, some materials that conduct electricity poorly may not be good insulators.

**Explore**

**Identifying Conductors and Insulators**

Students test various objects and materials to discover which are conductors and which are insulators.

**Management Note:** The following procedures are presented on pages 15-16 in students’ science notebooks. Briefly review them with students of fluent reading ability; direct the steps for children who have trouble following written instructions.

1. Have groups assemble bulb and battery circuits similar to the ones they made in Lesson 4. This time, however, specify that they use three wires. They should:
   a. Clip the end of one wire to the bulb holder, and tape the other end to a terminal of the D-cell battery.
   b. Clip the end of the second wire to the bulb holder, and leave the other end free to be a tester.
   c. Tape the end of the third wire to the other terminal of the D-cell battery, and leave the other end free to be a tester.
   d. Touch the two free wire ends together to see if the bulb lights. If it does, the tester is set up correctly.
2. Give each group a resealable plastic bag containing a collection of conductors and insulators. They should:
   a. Write the name of each object in the first column of the table on page 17 of their science notebooks.
   b. Predict whether the object is a conductor or insulator in the second column.

**Teacher Note:** If students are not yet familiar with what a prediction is, share the definition. Tell children that scientists conducting experiments don’t change written predictions, and neither should they, even if they later decide they were wrong. Predictions do not have to be correct.

c. Touch the object with the ends of the two free wires. If the bulb lights, the item is a conductor.

d. Record the results in the third column of the table.

**Teacher Note:** Let students know that the class will work together to identify the materials each object is made of. They do not need to fill in the fourth column of the table at this time.

3. If some groups finish before others, encourage them to continue investigating questions and ideas they might have developed. For example:
   - What happens if more than one conductive object is put between the two free wires?
   - What other objects in the room work as conductors or insulators?
   - Do some conductive objects make the light bulb shine more brightly than others?

**Safety Note:** Do not allow students to test wall outlets or anything plugged into an outlet. The voltage could be lethal.
Reflect and Discuss

Sharing and Synthesizing

1. While students still have their science notebooks open to page 17, show the Overhead Transparency “Identifying Conductors and Insulators.”

2. Ask volunteers from each group to identify the conductors and insulators on the list of objects, and write their identifications in the third column on the overhead transparency. Were they surprised by any of the results?

3. Have the class work together to identify the materials that each object was made out of (such as metal, glass, plastic, wood). Write the material types in the fourth column on the overhead transparency.

4. Ask the class whether they notice any patterns. Which materials made good conductors? (Metals) Which materials made good insulators? (Glass, rubber, wood, plastic, and others)

Teacher Note: Students may have noticed that with some conductive materials the light bulb shone more or less brightly. This is because some conductors are more conductive than others, just as some insulators are better at blocking current than others.

5. Note that all of the materials they tested were solids. But some liquids are also conductive. For example, good liquid conductors include salt water and lemon juice. Explain that human bodies contain lots of water and salt—which is why it’s easy for electricity to travel through us—so it’s possible for us to get shocked.

Teacher Note: If students show particular interest in liquid conductors, teach one of the Further Science Explorations.

6. Show the Overhead Transparency “Inside a Light Bulb.” Ask volunteers to point out which parts of the bulb are conductors and which parts are insulators. (The metal tip, wire attachment point, support wire, and filament are conductors. The ceramic insulator and glass bulb are insulators.)
7. Show the Overhead Transparency “Inside an Extension Cord.” Again, ask volunteers to point out which parts are conductors and which parts are insulators. *(The wires inside and metal prongs outside are conductors. The plastic covering is an insulator.)*

8. To conclude the lesson, have students answer the questions on pages 18-19 in their science notebooks. If you wish, discuss their responses as a class.
Ongoing Learning

Science Center

Give students opportunities to continue investigating questions and ideas they might have developed while testing conductors and insulators during the exploration.

Extending the Lesson

Further Science Explorations

Investigating the Conductivity of Salt-Water Solutions

1. Give students a beaker or plastic cup half-full of distilled water, plus a supply of salt, a spoon measurer, a stirrer, and paper towels.
2. Challenge students to measure how much salt they need to stir into the water before it becomes conductive. Have them begin by using the battery and bulb circuit to identify that the pure water is not conductive. They should dip the ends of the two free wires into the liquid and hold them close together, but not touching, to see if the bulb lights up.

   + SAFETY NOTE: Students must wear safety goggles and gloves. Warn them not to get the battery wet.

3. Have students record how many spoonfuls of salt they add, so that they can quantitatively describe how salty a solution must be before it is conductive. Once they have made a conductive solution, suggest that they move the two wire ends further apart to see how it affects the brightness of the bulb.

Making a Lemon-Aided Tongue Circuit

For each student who wants to try this activity, do the following:

1. Thoroughly wash a dime and a penny dated before 1987.
2. Cut two slits into a juicy lemon, about 1 cm (1/4 in) apart. Insert the coins halfway into each slit.
3. Have the student stick out their tongue and touch both coins with it. They should feel the tingling of electric current flowing.

matter connection

Having students prepare salt-water solutions reinforces the experience of mixing solutions introduced in the Science Companion Level 4 Matter Unit.
Identifying Conductors and Insulators

**Predictions and Results:**

<table>
<thead>
<tr>
<th>Object to be Tested</th>
<th>Prediction (Circle one)</th>
<th>Testing Result (Circle one)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor Holder</td>
<td>Conductor</td>
<td>Conductor</td>
<td>Insulator</td>
</tr>
<tr>
<td>Conductor Holder</td>
<td>Conductor</td>
<td>Conductor</td>
<td>Insulator</td>
</tr>
<tr>
<td>Conductor Holder</td>
<td>Conductor</td>
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<td>Insulator</td>
</tr>
<tr>
<td>Conductor Holder</td>
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<td>Conductor</td>
<td>Insulator</td>
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<tr>
<td>Conductor Holder</td>
<td>Conductor</td>
<td>Conductor</td>
<td>Insulator</td>
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<tr>
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<td>Conductor</td>
<td>Insulator</td>
</tr>
<tr>
<td>Conductor Holder</td>
<td>Conductor</td>
<td>Conductor</td>
<td>Insulator</td>
</tr>
<tr>
<td>Conductor Holder</td>
<td>Conductor</td>
<td>Conductor</td>
<td>Insulator</td>
</tr>
</tbody>
</table>

**Conclusion:**

Explain your results. How are the materials that worked to complete the circuit alike?
### Identifying Conductors and Insulators

**Date:**

**Procedures (continued):**

Text the object:

1. Fill in the table on the following page as you work.
2. Open your bag of conductors and insulators. Choose an object, and write down its name.
3. Predict whether the object is a conductor or an insulator. Don’t change your prediction.
4. Touch the object with the ends of the two tweezers.
   - If the bulb lights, it is a conductor.
   - If the bulb doesn’t light, it is an insulator.
5. Record your testing result.
6. Repeat steps 2-5 for each object.
7. Write down your conclusions. Fill in the Material columns of the table if you make a conclusion.

#### Object to Be Tested

<table>
<thead>
<tr>
<th>Object to Be Tested</th>
<th>Prediction (Circle one)</th>
<th>Testing Result (Circle one)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor</td>
<td>Insulator</td>
<td>Conductive</td>
<td>Metal</td>
</tr>
<tr>
<td>Conductor</td>
<td>Insulator</td>
<td>Non-conductive</td>
<td>Plastic</td>
</tr>
<tr>
<td>Conductor</td>
<td>Insulator</td>
<td>Conductive</td>
<td>Rubber</td>
</tr>
<tr>
<td>Conductor</td>
<td>Insulator</td>
<td>Non-conductive</td>
<td>Glass</td>
</tr>
<tr>
<td>Conductor</td>
<td>Insulator</td>
<td>Conductive</td>
<td>Ceramic</td>
</tr>
</tbody>
</table>

#### Conclusion

Explain your results. How are the materials that worked to complete the circuit alike?

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### Design Safe Gloves for an Electrician

**Date:**

**Design Safe Gloves for an Electrician:**

You need to design gloves for an electrician to wear. The gloves must protect the electrician from getting shocked by direct electricity.

1. **What material would you choose?**

2. **Why would this material make the gloves safe?**

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100 | ELECTRICAL CIRCUITS | LESSON 6 | IDENTIFYING CONDUCTORS AND INSULATORS
## Rubric 2: Current Electricity

<table>
<thead>
<tr>
<th>Criteria A (Lessons 3–5)</th>
<th>Criteria B (Lessons 3–5)</th>
<th>Criteria C (Lessons 6, 7)</th>
<th>Criteria D (Lesson 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For an electric current to flow, there must be a circuit. If there is no circuit, the current will stop, or loop. If there is a circuit, the current will flow through the circuit and return to its source.</td>
<td>The flow of electric current can produce light, heat, motion, or magnetic effects.</td>
<td>Some materials allow electric current to flow more easily than others.</td>
<td>It is important to avoid electrical hazards by using electricity safely.</td>
</tr>
</tbody>
</table>

### 4 - Exceeds Expectations

Expects the student’s competence and understanding of the lesson or concept. Shows in-depth understanding and application of the concept. Understands at a secure level and applies knowledge to situations involving electrical safety.

### 3 - Meets Expectations

Expects the student’s competence and understanding of the lesson or concept. Shows understanding of the concept. Understands that some materials conduct electric current more easily than others. Understands that some materials conduct electric current more easily than others. Understands that some materials conduct electric current more easily than others.

### 2 - Developing Approaches (Expectations)

Shows an increasing competency with lesson content. Has an incomplete understanding of the concept. Might be able to explain the concept but cannot explain the concept in depth. Recognizes the importance of electrical safety and can articulate the reasons why they are important. Understands that some materials conduct electric current more easily than others. Understands that some materials conduct electric current more easily than others. Recognizes the importance of electrical safety and can articulate the reasons why they are important.

### 1 - Beginning

Has no previous knowledge of lesson content. Does not understand an electric circuit. Does not recognize the flow of electricity. Does not recognize that some materials conduct electric current more easily than others. Does not recognize the importance of electrical safety.

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## Checklist: Predicting

### Checklist: Predicting

**Teacher Assessment**

*Lesson 3*

Determine whether the following skills are evident as the student makes predictions.

You might assign one point for each criterion that the student demonstrates. You can add specific observations or comments in the space below each criterion.

Name __________________________ DATE ____________

**Criteria:**

_____ A. Makes relevant predictions.

_____ B. Provides a rationale for predictions using related understandings, observations, and/or data.

_____ C. Revises predictions as pertinent information is discovered.

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26 | ELECTRICAL CIRCUITS | CONTENT RUBRICS OPPORTUNITIES OVERVIEWS

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101
Teacher Background Information

This section provides a detailed overview of concepts about electricity relevant to the Electrical Circuits Unit. It is intended to give you background information you may need as you teach the unit; however, it is not necessary to master or present all the content that is offered here. The Key Notes section of each lesson indicates which portion to review prior to teaching the lesson. A quick read-through before teaching the unit—to get the big picture—followed by more focused readings before each lesson should help you guide students in their discoveries about the role of electricity in the world around them.

Introduction

Electricity: A Challenging Concept

Electricity is present everywhere in our lives. Thunder and lightning are manifestations of naturally generated electricity. Electricity from power stations lights up our homes and cooks our food. It powers our computers, television sets, and other electronic devices. Electricity from batteries makes our flashlights shine in the dark, powers our cell phones, and starts our car engines.

Yet even adults struggle to understand how electricity works.

In order to conceptualize electricity, one must understand electric charge. Charge is a property of some of the particles that make up the atom. Understanding atomic structure is beyond the grasp of most elementary students. Therefore this unit does not introduce the concept of electric charge or its relation to the atom. Instead, the lessons provide children with a variety of concrete experiences with static and current electricity so that they have a foundation to build upon in later grades.

You might find students asking you questions outside the scope of content covered by the lesson explorations. As always, use your best judgment about whether students are ready to tackle abstract concepts, and about how much detail to provide when answering their questions. The following information will be valuable to you as a quick “go to” guide, and should make you more comfortable and confident teaching the unit.
the leader strokes get close to the ground, a large positive charge called a streamer stroke builds up on the ground. It rises until it meets the leader stroke. The meeting of these strokes creates a “channel” along which a second, much more powerful flash can run. This is called a return stroke. All of this happens too quickly to see with the naked eye. But it can be seen if you look at a lightning bolt in slow motion. In a lightning stroke, a very large amount of charge flows through the air, heating it up to produce the bright light. The heating of the air makes it expand rapidly, producing the large sound.

Benjamin Franklin was among the first scientists to suspect that lightning was electrical in nature. In 1752 he tested his idea by tying a metal key to a kite, and flying it in a thunderstorm. Sparks jumped to the wet string and key, and he felt an electric shock run through his body. Franklin’s investigations helped scientists figure out electric charge and led to further studies of electric current.

**Current Electricity**

**How Current Electricity Works**

Although static electricity is more prevalent in the natural environment than current electricity, electric current occurs in more man-made situations. Unlike static electricity, current electricity can exist in and move through a conductor only. A conductor is a material, such as a metal, that allows electrons to pass through it. In Benjamin Franklin’s experiment, the metal key was a conductor—as was the wet string and his body.

On an atomic level, current electricity occurs when a source of electrical energy makes loosely held electrons move from atom to atom in a conductor. The electrical source has two connections to the circuit. It creates an excess of free electrons at one connection and a shortage of electrons at the other. Because like charges repel, the excess electrons push away from each other, collide with the “loose” electrons in the next atoms, and continue knocking into the next electrons along the line. At the other end of the circuit, the electrons fill the electron deficit at the source. Each electron doesn’t actually move far or fast; but the movement of the electric charge—the current—does.

To picture how this works, imagine a line of marbles touching each other. If you were to flick your finger at the marble on one end, the marble at the other end of the line would shoot off. The marbles in the middle—like electrons in a conductor—wouldn’t move much at all.
What makes current electricity useful is that the electrical energy source makes the charges keep on moving. Even if you were to put the imaginary marbles in a circle, the energy supplied by your finger flick would eventually “run out.” The marbles would eventually stop moving. Continuously moving electric charge—what we know as the electricity that lights our buildings and makes our appliance work—requires a continued connection to an energy source.

Connection to an energy source means that electric current is really a secondary energy form. The primary energy source can be coal, natural gas, petroleum, nuclear power, hydropower, geothermal power, solar power, wind power, or—in the case of batteries—a chemical reaction. This energy is changed into electrical energy by some device such as a battery or generator. The primary energy source can be renewable (such as solar and wind power) or nonrenewable (such as coal and petroleum), but electricity itself is neither renewable nor nonrenewable. It is the movement of electrons, which are atomic particles of matter.

Along with needing a conductor and a power source, electrical current has one other requirement. It must move through a circuit. Like the circle of imaginary marbles, an electrical circuit is an unbroken loop.

**Simple Electrical Circuits**

Electrical circuits can be connected in many different ways, but they all have three essential parts: a conductor, a source, and a receiver. Even more importantly, electrical circuits must be constructed in an unbroken loop, like a circle. Unlike the circle of imaginary marbles, an electrical circuit is made of conductive material that passes electrons easily (such as copper wire), and it is powered by a continuous energy source that pushes the electrons around the loop (such as a battery or generator).

An electrical circuit also has a receiver, which is the equipment being powered by the electrical current. The receiver converts electrical energy into other kinds of energy, such as heat, light, or sound. In Lessons 3-6, students work with different receivers: light bulbs, motors, and buzzers.

For example, in a simple circuit electric charges move away from a battery, pass through atom after atom of copper wire and the wires in a light bulb, and travel back to the battery. Every part of the circuit is conductive, including the path through the battery and bulb. The tungsten filament of the bulb, though, has a higher resistance than the copper wire. When the charges move through the higher resistance filament, they change electrical energy into heat energy, and the filament glows.
When the circuit is connected, all of the atoms in the circuit pass electrons and current electricity flows at every point. Electrons don’t race from one end of the circuit to the other; they all move at once. This is why the light bulb lights up immediately, as soon as both ends of the battery are connected to the circuit. The process is as continuous and instantaneous as turning on a faucet to run water out of a full pipe.

The most important idea for students to take away from this unit is that electrical current only flows through a complete circuit. With a battery in place, electric current flows from one battery terminal, through the circuit, and back into the other battery terminal. The same amount of current flows out of one battery terminal and into the other; the battery is part of the continuous loop.

When a light bulb is added to a circuit, the electric current must flow into its conductive metal tip, through a supporting wire, meet resistance in the filament, and exit the bulb through another supporting wire. The light bulb is part of the complete circuit that includes the battery.

Children’s Ideas About Current Electricity and Electrical Circuits

In Lesson 3, students receive their first introduction to simple electrical circuits. The lesson begins by having students draw their conceptual models about how to light a bulb using a battery and one wire. The intent is to have students reveal their assumptions about how current electricity works.

The idea that most students bring with them is a one-way “source-consumer” model. They believe that the battery is a source of electric current, the light bulb is a consumer of current, and one just touches the ends of a wire to each for the bulb to light. They envision the process as being a one-way flow of electric current from battery to bulb. One reason for this belief may be the view of an electrical cord as a single wire coming from an outlet (not knowing that the cord has two wires inside it).

When they test their ideas, though, students will discover that a one-way configuration does not work. After trial-and-error, they will discover that the two terminals of the battery must be included, as well as two different metal parts of the light bulb.
In the beginning, some students will insist that two wires are necessary. Although they will learn in Lesson 3 that isn't true, they may feel more confident in their understanding after Lesson 4. In this lesson students light a bulb with a battery and two wires.

Most students will reject the “source-consumer” model after their experiences in Lesson 3, but some may believe that the second wire in Lesson 4 is an unnecessary extra, perhaps used as a “ground.”

Still some other students may hold onto a belief that electricity runs from the battery, through two wires, and to the bulb. They may hold the idea that two wires are needed to supply “enough” energy for the bulb to stay lit, or they may think that charges travel through both wires and meet to “spark” at the light bulb.
Another misconception may be that some electricity returns to the battery through the second wire, but not as much as entered the bulb. These students still consider the light bulb a consumer of electric current.

In Lesson 4, after connecting a circuit with two wires, students closely examine a light bulb, discuss illustrations of a bulb and an extension cord, and trace the looped path of an electric current through a complete circuit. At this time students should understand the correct configuration of a simple circuit.

This unit provides guided inquiry into simple series circuits only. However, there is a good chance that students investigating batteries, wire, and bulbs in the Science Center will rig up more complex variations of series circuits. For example, students may wire more than one light bulb together along the loop leading to and from the battery. They will observe that the light bulbs glow more dimly, and they may also discover that when one light bulb burns out, the circuit is broken and none will light. Students may also try adding batteries to their series circuit. They will observe that the light bulbs glow more brightly.

### Putting Current Electricity to Work

What makes electricity most interesting is what can be done with it. Electric current can be put to work to make light and heat, turn motors, make sounds, and produce magnetic effects.

In Lessons 3 and 4, students light bulbs. In Lesson 5 they use electric current to make motors turn and buzzers sound. They even make electromagnets. With an introduction to these basic electrical devices, students can begin to inquire about their roles in more complex machines. For this reason, we strongly encourage you to provide small appliances for the class to take apart in the Science Center after Lesson 5. Through their ongoing investigations, students will recognize that all devices and machines powered by electric current contain an electric circuit.

Some students may have questions about electromagnets. In Lesson 6, the students produce magnetism with an electric current. When an electric current flows through a wire, it creates a magnetic field around the wire. By coiling the wire many times around a core of iron or steel, the magnetic field can be made even stronger, and the core can become a temporary magnet. This magnetic field can produce a force on some part of a device to cause motion. As students discover in this lesson, inside an electric motor there is an electromagnet. When the electric current is combined with rotating magnets, the motor turns.
With continued exposure to electrical devices, students will become increasingly familiar with the necessary components of electric circuits. In Lesson 6, they examine solid materials that conduct electric current, and recognize that the conductors are metal. This discovery reinforces the idea that electric current flows around a circuit defined by conductive materials. The metal parts of a light bulb, a buzzer, and a motor are all conductive. When a device’s parts are not supposed to conduct electricity, then they are made of plastic, glass, or some other kind of insulator.

Students explore the practical applications of current electricity in Lesson 7. In this final lesson of the Electrical Circuits Unit, students extend their understanding of conductors and insulators by identifying potential electrical hazards, discussing what makes them hazardous, and considering what they can do to prevent electrical hazards from occurring. The lesson reinforces the idea that current electricity flows only through a closed loop, and that the circuit must contain conductive materials, an energy source, and a receiver. Unwanted and dangerous electric current can be eliminated by opening or interrupting a circuit. Insulators can be used in place of conductors. The energy source can be removed. Another hazardous condition that students may find interesting is a short circuit, which can be created by the crossing of uninsulated wires so that current can flow without passing through the receiver or any resistance. This results in a large amount of current flowing and the possibility of high heat and fire.

**More About Batteries in Use**

Look at one of the D-cell batteries provided for students’ circuits. It has two metal terminals at the ends. One is marked “+” (positive) and one is marked “−” (negative). If—as students might—you connect the positive terminal to the negative terminal with a metal wire, you will see a spark when you connect them and another when you disconnect. If you hold the connection between the two terminals, the wire will get hot and the battery will run down in a minute or two. (In the interest of conserving your D-cell supply—and in preventing burns—discourage students from trying this.) Without any device attached to create resistance, a short circuit is produced.

Another phenomenon, which students will observe in Lesson 6, is electromagnetism. If you were to hold the short-circuit wire close to a magnetic compass, you would see the needle deflect. This comes from a magnetic field generated by the electric current. When students make electromagnets in Lesson 6, they may also feel some warmth where the magnet wire connects to the battery terminals.
The Science Notebook is a student’s ongoing record of his or her work as a scientist. Each Science Companion module for grades 1-6 has a Student Science Notebook tailored for that module.

Student Science Notebooks are age-appropriate. Notebooks for younger grades contain minimal text and opportunities to draw instead of write, so all students can participate and shine as scientists. For older grades, Student Science Notebooks utilize students’ developing skills: they contain procedures for students to follow, and provide support for controlling variables as students develop their own experiments—all leading to increased independence.

All the Student Science Notebooks develop literacy and support mathematics skills. Students apply these disciplines in the highly motivating process of doing science.
Hello Scientist,

Welcome to the Electrical Circuits unit. This notebook is your place to record discoveries about electricity. Like all scientists, you will wonder, think, try, observe, record, and discover. As you do so, it is important to keep a record of your work. Your questions, investigations, answers, and reflections can then be shared and returned to at any time.

We know much about science, but there is much more to be learned. Your contributions start here.

Enjoy, take pride in, and share your discoveries—science depends on scientists like you!
Identifying Conductors and Insulators

Investigative Question: What objects or materials can be used to complete a circuit?

Materials:
- Bulb holder with bulb
- Three 15-cm wires with stripped ends
- D-cell battery
- Electrical tape
- Bag of conductors and insulators

Procedure:

Make a tester

1. Clip the end of one wire into the bulb holder. Tape the other end of the wire onto one end of the D-cell.
2. Clip the end of a second wire into the bulb holder. Leave the other end free.
3. Tape the end of the third wire onto the other end of the D-cell. Leave the other end of the wire free.
4. Touch the two free wire ends together. If the bulb lights, you have set up your tester right.
Identifying Conductors and Insulators

Procedure (continued):

Test the objects

1. Fill in the table on the following page as you work.

2. Open your bag of conductors and insulators. Choose an object, and write down its name.

3. Predict whether the object is a conductor or an insulator. Don’t change your prediction!

4. Touch the object with the ends of the two free wires.
   • If the bulb lights, it is a conductor.
   • If the bulb does not light, it is an insulator.

5. Record your testing result.

6. Repeat steps 2-5 for each object.

7. Wait for your class to fill in the Material column of the table together.
Identifying Conductors and Insulators

Predictions and Results:

<table>
<thead>
<tr>
<th>Object To be Tested</th>
<th>Prediction (circle one)</th>
<th>Testing Result (circle one)</th>
<th>Material</th>
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<tbody>
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</table>

Conclusion:

Explain your results. How are the materials that worked to complete the circuit alike?
Design Safe Gloves for an Electrician

You need to design gloves for an electrician to wear. The gloves must protect the electrician from getting shocked by current electricity.

1. What material would you choose?

2. Why would this material make the gloves safe?
3. What problems might come from making or wearing gloves from this material?
Hola Científico,


Nosotros sabemos mucho sobre ciencia, pero existe mucho más que se puede aprender. Tus contribuciones comienzan aquí.

¡Diviértete, siéntete orgulloso, y comparte tus descubrimientos—la ciencia depende de científicos como tu!
Identificando Conductores y Aislantes

Pregunta Investigadora: ¿Qué objetos o materiales se pueden utilizar para completar un circuito?

Materiales:
- Base para foco con un foco
- Tres alambres de 15 centímetros con las puntas descubiertas
- Batería tamaño D
- Cinta eléctrica
- Bolsa de conductores y aislantes

Procedimiento:

Haz un probador

1. Sujeta la punta de un alambre a la base para foco. Pega la otra punta del alambre a uno de los lados de la batería tamaño D.

2. Sujeta la punta del segundo alambre a la base para foco. Deja la otra punta libre.

3. Pega la punta del tercer alambre al otro lado de la batería tamaño D. Deja la otra punta libre.

4. Junta las dos puntas libres. Si el foco se prende, has formado el probador correctamente.
**Identificando Conductores y Aislantes**

**Procedimiento (continuación):**

**Prueba de objetos**

1. Llena la tabla en la siguiente página.

2. Abre la bolsa de conductores y aislantes. Escoge un objeto, y escribe su nombre.

3. Predice si el objeto es un conductor o un aislante. No cambies tu predicción!

4. Toca el objeto con las puntas de alambres que están desconectadas.
   - Si el foco se prende, es un conductor.
   - Si el foco no se prende, es un aislante.

5. Escribe tus resultados.

6. Repite los pasos 2 a 5 para cada objeto.

7. Espera a tu clase para llenar juntos la columna de Materiales en la tabla.
Fecha: _______________________

Identificando Conductores y Aislantes

Predicciones y Resultados:

<table>
<thead>
<tr>
<th>Objeto que será probado</th>
<th>Predicción (circula uno)</th>
<th>Resultados de Prueba (circula uno)</th>
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<td>Aislante</td>
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</table>

Conclusión:

Explica tus resultados. ¿Cómo son similares los materiales que funcionaron para completar el circuito?
Diseña Guantes de Protección para un Electricista

Necesitas diseñar guantes para un electricista. Los guantes deben de proteger al electricista de ser electrocutado por una corriente eléctrica.

1. ¿Qué materiales vas a escoger?

2. ¿Por qué es que éste material hará que los guantes sean seguros?
Diseña Guantes de Protección para un Electricista

3. ¿Qué problemas podrían suceder al hacer o utilizar guantes de éste material?
Assessments

Science Companion supplies a variety of tools to assess children “in-the-act” of doing science, as well as evaluate their understanding and proficiency as they finish clusters of lessons.

In the Teacher Lesson Manual:
- Big Ideas and lesson goals are clearly outlined on each lesson’s Quick Look pages.
- Assessment Options in each lesson suggest where pre-assessment and formative assessment can occur in the context of a lesson.

In the Assessment Book:
- Rubrics are supplied to score understanding of science content. The criteria in each rubric are derived from a module’s Big Ideas and lesson goals.
- Opportunities Overviews show where each criteria can be evaluated during pre-assessment, formative assessment and summative assessment.
- Checklists and Self-Assessments list criteria that are related to science process skills.
- Performance Tasks are used for summative assessment to evaluate students’ understanding of Big Ideas and lesson goals. The Assessment Book supplies evaluation guidelines and blank masters for each Performance Task.
- Quick Checks—another summative assessment tool—employ a multiple-choice format.

The Science Notebook Teacher Guide:
A final assessment tool is the Science Notebook Teacher Guide. This teacher edition of the Student Science Notebook is annotated to help teachers know what to expect in from children in their Student Science Notebooks.

www.sciencecompanion.com
Rubric 2: Current Electricity

<table>
<thead>
<tr>
<th>Criterion A (Lessons 3—5)</th>
<th>Criterion B (Lessons 3—5)</th>
<th>Criterion C (Lessons 6, 7)</th>
<th>Criterion D (Lesson 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For an electric current to flow, there must be a complete path or loop for it to follow around a circuit and return to its source.</td>
<td>The flow of electric current can produce light, heat, sound, motion, or magnetic effects.</td>
<td>Some materials allow electric current to flow more easily than others.</td>
<td>It is important to avoid electrical hazards by using electricity safely.</td>
</tr>
</tbody>
</table>

**4 - Exceeds Expectations**
Explores content beyond the level presented in the lessons.

**3 - Secure (Meets Expectations)**
Understands content at the level presented in the lessons.

**2 - Developing (Approaches Expectations)**
Shows an increasing competency with lesson content.

**1 - Beginning**
Has no previous knowledge of lesson content.

Some materials allow electric current to flow more easily than others. For example, might recognize that electric current can produce light, but does not realize that it can produce sound.

Recognizes electrical hazards and can articulate the reasons why they are hazards in terms of safe electricity usage.

Recognizes a few electrical hazards, but does not recognize most of them.

Does not understand that some materials conduct electric current more easily than others.
Opportunities Overview: Current Electricity

This table highlights opportunities to assess the criteria on Rubric 2: Current Electricity. It does not include every assessment opportunity; feel free to select or devise other ways to assess various criteria.

<table>
<thead>
<tr>
<th>Criterion A (Lessons 3-5)</th>
<th>Criterion B (Lessons 3-5)</th>
<th>Criterion C (Lessons 6, 7)</th>
<th>Criterion D (Lesson 7)</th>
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<tr>
<td><strong>Pre and Formative Opportunities</strong></td>
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<td>- Exploration</td>
<td>- Reflective discussion</td>
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<td>Lesson 5:</td>
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<tr>
<td>Light a Bulb, page 29</td>
<td>Light a Bulb, page 29</td>
<td>Conductors and Insulators, page 32</td>
<td>Electrical Safety, page 34</td>
</tr>
<tr>
<td>Trace the Electric Current, page 30</td>
<td>What Use is Electricity, page 31</td>
<td>Design Safe Gloves for an Electrician, page 33</td>
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<td><strong>Summative Opportunities</strong></td>
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<td>Page 38, items 1-4</td>
<td>Page 39, item 5</td>
<td>Page 39, item 6</td>
<td>Page 39, items 7-8</td>
</tr>
</tbody>
</table>
Checklist: Predicting
Teacher Assessment
(Lesson 3)

Determine whether the following skills are evident as the student makes predictions. You might assign one point for each criterion that the student demonstrates. You can add specific observations or comments in the space below each criterion.

Name __________________________________ Date__________

Criteria:

_______ A. Makes relevant predictions.

_______ B. Provides rational for predictions using related understandings, observations, and/or data.

_______ C. Revises predictions as pertinent information is discovered.
Conductors and Insulators
Current Electricity Cluster (Lesson 6)

Directions:

1. Look at the picture of a light bulb.

2. Label the parts and materials that work as conductors. Label the parts and materials that work as insulators.

Teacher Note:

Use this assessment after teaching Lesson 6.

Evaluation Guidelines:

When evaluating student answers, consider whether they include the following elements in their written explanations:

- Wires, wire attachment point, metal tip, filament—labeled as conductors
- Ceramic base, glass—labeled as insulators
- Advanced responses might identify the materials as metal, glass, or ceramic.
Design Safe Gloves for an Electrician
Current Electricity Cluster (Lesson 6)

**Teacher Note:**
This is a reproduction of the science notebook page students will complete as part of Lesson 6.

1. **What material would you choose?**
Students should choose materials that do not easily conduct electricity. Possible answers include:

- Leather
- Plastic
- Vinyl
- Rubber
- Cloth
- Wood

2. **Why would this material make the gloves safe?**
The material is not a good conductor of electricity.

3. **What problems might come from making or wearing gloves from this material?**

**Evaluation Guidelines:**
When evaluating student answers, note if they consider whether designs that are best for reasons of safety may not be best for reasons of cost, ease of use, or appearance.
5. (Lesson 5) Put an X next to any effect that electric current can produce.

- [X] sound
- [X] motion
- [X] light
- [X] heat
- [X] magnetism

6. (Lesson 6) Which of the following objects would make a good conductor of electric current?
   a. copper wire
   b. silver spoon
   c. iron nail
   d. all of the above

7. (Lesson 7) Which of the following statements about electrical safety is FALSE?
   a. Never set a radio on the edge of a bathtub while you are taking a bath.
   b. Use baby-proof covers on electrical outlets if you have young children at home.
   c. Use a metal fork if a bagel gets stuck in your toaster.
   d. Never fly a kite near a power line.

8. (Lesson 7) True or False? If false, rewrite the statement to make it true.
   Human beings can conduct electric current. ___________ True
Teacher Masters may be reproduced and used during lessons. Their uses vary—they may be used by individuals, in groups, or as reference sheets for teachers or adult helpers in the classroom.

Family Letters (introductions to the module) and Family Links (homework or optional activities) are also in the Teacher Masters.

Visuals include posters and pictures that may be displayed or projected in the classroom during lessons. In some cases, Visuals may also include cardstock games that are used during lessons.
Inside an Extension Cord
## Identifying Conductors and Insulators

**Predictions and Results:**

<table>
<thead>
<tr>
<th>Object To be Tested</th>
<th>Prediction (circle one)</th>
<th>Testing Result (circle one)</th>
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<td></td>
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<td>Insulator</td>
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<tr>
<td></td>
<td>Conductor</td>
<td>Insulator</td>
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</tbody>
</table>

**Conclusion:**

Explain your results. How are the materials that worked to complete the circuit alike?
ExploraGear® Items

The ExploraGear® provides all of the hard-to-find, hands-on materials needed to effectively implement a Science Companion module. This kit of non-consumable and consumable items is your go-to place for the tools needed to teach inquiry science. The authors of Science Companion carefully developed the curriculum so that the ExploraGear® items are not overwhelming and unfamiliar, but filled with the most essential, high quality items needed to engage students in a rich, interactive, inquiry science experience.
I Wonder: notice, ask questions, state problems
I Think: consider, gather information, predict
I Try: experiment, model, test ideas, repeat
I Observe: watch, examine, measure
I Record: record data, organize, describe, classify, graph, draw
I Discover: look for patterns, interpret, reflect, conclude, communicate discoveries
What’s in Science Companion?

For the Teacher

Teaching and Assessment

- Teacher Lesson Manual
- Assessment Book
- Student Notebook Teacher Guide

Great Classroom Support

- Reference Materials
  - Teacher Reference Materials
  - Lesson O
- Teacher Masters
- Visual Aids
  - Transparencies and Posters
  - I Wonder Circle® Poster in English & Spanish

ScienceCompanion®
www.sciencecompanion.com
I Discover...

What’s in Science Companion?

For the Student:

Classroom Supplies

Student Science Notebook
English & Spanish

ExploraGear® Kit

Great Curriculum Support

Student Reference Book
(Levels 4-6)

What Is a Scientist?
(Levels K-3)

Trade Books

Curriculum now available in print and digital!

ScienceCompanion

www.sciencecompanion.com
Collecting and Examining Life
From collecting animal tracks to dissecting flowers, children deepen their understanding of what makes something alive as well as exploring the similarities and differences among living things.

Rainbows, Color, and Light
Through experiments with prisms, mirrors, bubbles, water, sunlight, and flashlights, children bring rainbow effects into their classroom and onto the playground. They also mix colors to observe that colored light produces different results than mixing pigmented paints, dough, or water.

Solids, Liquids, and Gases
While deciding what makes a solid a solid, watching water disappear from an open cup, or comparing various liquids, children find the value in asking questions and probing the world around them for meaningful answers.

Motion
Through activities that engage children’s bodies and minds, children move their own bodies in various ways to learn about motion, as well as build ramps, roll toy cars, drop and crash marbles, slide pennies and shoes, and even fly paper airplanes.

Life Cycles
From watching a pea sprout to feeding apples to butterflies, children closely study four organisms, including humans, to observe the remarkable growth and change that living things experience during their life spans.

Early Science Explorations
From making a collage of the leaves and seeds they find to constructing a lever from rocks and wood, children are introduced to the wonders of science and scientific exploration. Contains 7 studies in one book: Growing and Changing; Class Pet; Collections from Nature; Constructions; Dirt, Sand and Water; Sky and Weather; and My Body.

Soils
From closely observing soil components and their properties to discovering the importance of earthworms, children use their senses of sight, smell, and touch to explore the wonders of soil.

Weather
One day students learn to use a thermometer to record temperature, another day they measure rainfall or investigate the nature of ice. Throughout the year, students use their senses as well as scientific tools to discover that weather is a dynamic part of nature.

Magnets
From testing what sort of everyday objects are attracted to magnets to comparing the strength of different magnets, children deepen their observation skills while learning about the nature of magnets.

Rocks
One day children examine fossils, another day they might test minerals. As children collect, examine, describe, and experiment with rocks, minerals and fossils, they hone their observation skills and begin to unravel the puzzle of what rocks are and how they are formed.
Habitats
From going on a nature walk to dissecting owl pellets, children are asked to think about how organisms (plants, animals, fungi, and microscopic living things) survive in the places they live, and how they interact with other living things.

Light
Whether watching light “bend” a pencil in water or building a periscope, the combination of hands-on, multi-sensory learning enables children to understand what light is, how it behaves, and why it makes sight possible.

Our Solar System
One day children chart the moon’s cycles, another day they might make a scale model of our solar system. By observing the world around them, they address questions such as “Why are there seasons?” and “Why does the moon appear to change shape?”

Watery Earth
Whether following a drop of water through the water cycle, measuring their own water usage, or exploring how filters clean dirty water, students are encouraged to use what they learn to have a positive impact on water resources.

Human Body in Motion
By modeling how muscles move bones, testing reflexes, and measuring the effects of exercise on breathing and heart rate, students begin to appreciate the interactions between body parts and recognize the importance of protecting them by making healthy choices.

Force and Motion
By demonstrating and explaining ways that forces cause actions and reactions, as well as gaining a deeper understanding of basic forces such as friction and gravity, students discover the many ways that forces affect the motion of objects around them.

Science Skill Builders
With 21 lessons spanning the breadth and depth of science skills, students develop a core understanding of using tools in science, scientific testing, observation skills, and the importance of analysis and conclusions.

Electrical Circuits
Whether exploring static charges, figuring out how to get a light bulb to light, or testing the conductivity of everyday objects, students experience firsthand the excitement of electricity and scientific discovery.

Nature’s Recyclers
By watching composting worms create soil, to modeling the nutrient cycle, students have the opportunity to investigate the organisms that carry out the process of decomposition and recycle nutrients in an ecosystem.

Earth’s Changing Surface
From building river models that explore erosion and deposition to touring the school grounds looking for evidence of the earth’s changing surface, students use hands-on investigations to discover the dynamic nature of the earth’s surface.

Earth Science

Matter
With challenges like exploring what they can learn about an unknown substance called “Whatzit,” students experience the excitement of scientific discovery and gain an appreciation of the scientific method used by professional scientists.

Energy
Whether testing the efficiency of light bulbs, exploring heat conduction, or designing an imaginary invention demonstrating the transfer of energy, students discover that energy is at the root of all change occurring in the world around them.

Design Projects
The design project series was developed to support compatible modules by allowing students to design and/or build animal homes, tools, machines, and designs of their own creation. Taking between 4-6 sessions, the projects strengthen skills and ideas about choosing materials, using tools, working with the limitations of materials, solving problems, and overall project design.
<table>
<thead>
<tr>
<th>Program Features</th>
<th>FOSS</th>
<th>Science Companion</th>
<th>STC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepares students to do inquiry-based science</td>
<td>✓</td>
<td>Lesson O introduces students to the scientific method through the “I Wonder” Circle</td>
<td></td>
</tr>
<tr>
<td>Hardback, colorful, content-rich student reference materials for upper elementary students</td>
<td>✓</td>
<td>Student Reference Books</td>
<td></td>
</tr>
<tr>
<td>Bound student science notebooks to foster student literacy and reading skills</td>
<td>✓</td>
<td>The original Student Science Notebooks</td>
<td></td>
</tr>
<tr>
<td>Parallels in instructional design to <em>Everyday Mathematics</em>®</td>
<td>✓</td>
<td>Developed by the creators of <em>Everyday Mathematics</em>®</td>
<td></td>
</tr>
<tr>
<td>Variety of assessment strategies</td>
<td>✓</td>
<td>Teacher-friendly formative and summative assessment strategies</td>
<td>✓</td>
</tr>
<tr>
<td>A variety of pilot options to fit the interests and needs of districts</td>
<td>✓</td>
<td>Several no-cost pilot options, including an innovative online pilot program</td>
<td></td>
</tr>
<tr>
<td>Correlations to local and state science standards</td>
<td>✓</td>
<td>Correlated to state standards with customized local standard correlations available upon request</td>
<td></td>
</tr>
<tr>
<td>Teacher must gather minimal teacher supplied items</td>
<td>✓</td>
<td>ExploraGear and Supplemental Classroom Supplies available</td>
<td>✓</td>
</tr>
<tr>
<td>Early Childhood activity-based modules available</td>
<td>✓ (K Only)</td>
<td>Modules developed specifically for PreK-K available</td>
<td></td>
</tr>
<tr>
<td>Unique content offered to meet standards</td>
<td>✓</td>
<td>Light and Rainbows, Color, and Light modules available</td>
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</tr>
<tr>
<td>Children develop science habits of mind in addition to content knowledge</td>
<td>✓</td>
<td>“I Wonder” Circle integrates modules as tool for student reflection</td>
<td></td>
</tr>
<tr>
<td>Engaging activities nourish children’s curiosity</td>
<td>✓</td>
<td>Engaging, hands-on activities focused on Big Ideas</td>
<td>✓</td>
</tr>
<tr>
<td>Supports teachers in reaching Big Ideas</td>
<td>✓</td>
<td>Reflective Discussions help children integrate their experience and build science knowledge</td>
<td></td>
</tr>
<tr>
<td>Full curriculum available digitally</td>
<td>✓</td>
<td>Hyperlinked teacher materials (iTLM’s) &amp; digital student materials build affordable access</td>
<td></td>
</tr>
</tbody>
</table>

www.sciencecompanion.com
An Innovative Free Online Pilot Program!

We know that both time and financial resources are limited for school districts these days.

So, we are delighted to introduce an exciting new digital opportunity for you to try Science Companion materials at no cost, at a scale that is easily manageable. And it’s high tech, too!

Come to our Online Pilot Website and find:

- Sample lessons from eight of our modules.
- Conversation and support from content and teaching experts.
- Free digital teacher materials and student resources.
- Directions on how to order ‘lending library’ for kit materials.
- A pilot that will give you a rich taste of inquiry science but requires no more than a handful of classroom sessions.

“I think this is an awesome resource for doing science.”

Field Test Teacher

There are a limited number of online pilots available, so contact us now to find out how you can explore Science Companion at your pace, for free.

(And, of course, we have traditional pilots available too. Just ask!)
The spirit of inquiry. An invitation to curiosity. The tools for success.

Professional Development
Succeed with Science Companion

Inquiry-based learning in science is exciting, effective, and evocative. It also can be challenging. We can help you take the mystery out of inquiry!

**Philosophy**
A half-day session introducing the methodology, pedagogy, and best practices of Science Companion.

**Implementation**
Building from specific modules your district is using, a hands-on exploration of how to best implement Science Companion in your classrooms.

**Assessment and Science**
Formative and summative assessment can work together to strengthen teaching and test scores!

**Coming from Everyday Math**
Science Companion was developed by the same researchers who developed Everyday Mathematics, and many of the same pedagogical tools are used. Making the jump to Science Companion is easy!

**Train the Trainers**
Build a community of Science Companion experts in your district or intermediate unit.

**It’s in the Bag!**
Fully customizable workshops to meet your needs. Contact us to learn how we can best help you!

**Designed by the University of Chicago’s Center for Elementary Math & Science Education.**

**Participants**
Teachers and administrators in districts using Science Companion.

**Length**
Mix and Match to your needs to build a half day or full day session.

**Continuing Education**
CEU’s available, please ask us about we can work with you to arrange credits.

**Cost**
Ask your rep for more information!
Contact Us!

Get a Full Curriculum Sample
Check out a Pilot Program
Get a Custom Scope & Sequence
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Click either link for more information!

ScienceCompanion®
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