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**In-Class Field Trip:**

**It’s Electric!**

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| **Estimated Time: Two 45-Minute Class Segments** |
| **GSE Standard and Element(s):****S5P2. Obtain, evaluate, and communicate information to investigate electricity.** a. Obtain and combine information from multiple sources to explain the difference between naturally occurring electricity (static) and human-harnessed electricity. b. Design a complete, simple electric circuit, and explain all necessary components. c. Plan and carry out investigations on common materials to determine if they are insulators or conductors of electricity. |
| **Science and Engineering Practices**Planning and Carrying Out InvestigationsConstructing Explanations and Designing SolutionsEngaging in Argument from EvidenceObtaining, Evaluating, and Communicating Information | **Disciplinary Core Idea**PS2.B: Types of InteractionsPS3.B: Conservation of Energy and Energy TransferPS3.C: Relationship Between Energy and Forces |
| **Crosscutting Concepts**Cause and EffectEnergy and MatterStability and Change |
| **Authentic Scenario (Phenomena):**When I drag my shoes, while walking, across a carpeted room and then touch a metal doorknob I get shocked. | **Vocabulary:*** static
* current
* circuit
* complete circuit
* simple circuit
* series circuit
* electrical energy
* conductor
* insulator
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| **Guiding Questions:**What is electricity?What things produce current electricity?How do you produce static electricity?Why do bulbs light?Why does a charged balloon attract or repel?In a circuit, what must you do to light a bulb?How are conductors and insulators different?How do you know if an item is a conductor or an insulator? |
| **Materials Needed:*** balloons
* D cell batteries
* flashlight or other 1.5 bulb
* 10-15 cm insulated wires (extras will be needed for the Elaborate portion of the lesson)
* gallon plastic zip-top bags
* scissors (to strip wire)
* Post-It wall poster board or legal sized copy paper
* tape
* bulb holders
* colored pencils

Materials for Insulators and Conductors Activity* eraser
* metal pen
* paper envelope
* paper clip
* pencil
* piece of chalk (small)
* penny
* spoon
* nail
 | **Safety Considerations:*** Students should be careful while conducting experiments. The wires are sharp, and the glass bulbs can break.
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|  **Technology Integration:*** A device with Internet access to use the following:
	+ School Tube- Bill Nye’s Static Electricity: <https://www.schooltube.com/media/0_r4382s00>
* Physics4kids.com- Electricity: <http://www.physics4kids.com/files/elec_intro.html>
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| **Literacy Connections:*** *Making a Circuit (It's Electric!)* by [Chris Oxlade](https://www.amazon.com/Chris-Oxlade/e/B001HPOR74/ref%3Dpd_sim_14_bl_7?_encoding=UTF8&refRID=P8SCR7YWP33PCRS1MA9B)
* *Conductors and Insulators (It's Electric!)* by [Chris Oxlade](https://www.amazon.com/Chris-Oxlade/e/B001HPOR74/ref%3Ddp_byline_cont_book_1)
* *Oscar and the Bird: A Book about Electricity* by [Geoff Waring](https://www.amazon.com/Geoff-Waring/e/B001H6WAKO/ref%3Ddp_byline_cont_book_1)
* *What Is Electricity?* by [Lisa Trumbauer](https://www.amazon.com/Lisa-Trumbauer/e/B001ITXJ2S/ref%3Ddp_byline_cont_book_1)
* *Charged Up: The Story of Electricity (Science Works)* by Jacqui Bailey & Matthew Lilly
* [*How Ben Franklin Stole the Lightning* by Rosalyn Schanzer](https://www.amazon.com/How-Ben-Franklin-Stole-Lightning/dp/0688169937/ref%3Dsr_1_5?s=books&ie=UTF8&qid=1467828843&sr=1-5&keywords=ben+franklin+for+kids)
* [*The Magic School Bus and The Electric Field Trip* by Joanna Cole & Bruce Degan](https://www.amazon.com/Magic-School-Electric-Field-Trip/dp/0590446835/ref%3Dsr_1_5?s=books&ie=UTF8&qid=1467829007&sr=1-5&keywords=electricity+for+kids)
* *Electrical Circuits* by Lewis Parker
* *When Charlie McButton Lost Power* by [Suzanne Collins](https://www.amazon.com/Suzanne-Collins/e/B001H6V7I0/ref%3Ddp_byline_cont_book_1)
* *Magnets and Sparks* by Wendy Madgwick
* *Amazing Magnets* by David Adler
* *Magnets* by Janice VanCleave
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| **Engage** | Ask students to think about a time they dragged their shoes across a carpet and then touched a metal doorknob. Ask, “What happened?” (ESR: “I was shocked!”) Have students think-pair-share other times they have had experiences like this. Ask, “What did your experiences have in common?” (ESR: I dragged feet/shoes across a carpet and shocked another person. Objects were attracted to each other, e.g., socks stuck together in the dryer. I pulled apart the socks from the dryer that were stuck together and saw a spark. Objects were repelled from each other, e.g., hair standing on end when a hat is removed. Etc.) Gently rub an inflated balloon on a student’s head for about 15 seconds to charge the balloon. Lift the balloon about 6 inches above the student’s head. Have students observe what is happening to the student’s hair. Repeat lifting the balloon from other student’s heads. Ask, “Why is his/her hair following the balloon?” (ESR: The hair is attracted to the balloon.) Explain: A spark is caused by a discharge of static electricity. Point out to students that all of their experiences are related to static electricity and that in this lesson they are going to continue to investigate static electricity and also learn about simple circuits and insulators and conductors.  |
| **Explore** | Ask, “Imagine that you are hiking with a friend in the mountains. You stumble and fall. Your flashlight falls out of your backpack. It rolls down the hill and out of sight. It is getting dark, and you will need another light source. What should you do to create another light source?” Display one set of materials in a plastic zip-top bag (1 D cell battery, one 10-15 cm wire with stripped ends, and 1 bulb). Have students think-pair-share how they might use these materials to light the bulb. Chart student responses. Distribute one set of materials in a plastic zip-top bag (1 D cell battery, one 10- 15 cm wire with stripped ends, and 1 bulb) to each group of two students. Ask students to use the materials in their bag to light the bulb. Once students have successfully lit the bulb, encourage them to try to light the bulb in a different way. |
| **Explain** | Have each student draw a diagram of how they assembled the materials to light the bulb in their science notebooks. Have students label their diagrams with the following words: D cell battery, wire, and bulb. Have each group draw their complete circuits on a piece of copy paper or sticky poster note and stick them to the board or around the room. Ask students what they notice about the diagrams. (ESR: There are many ways to light the bulb.)Ask, “What do all of the complete circuits have in common?” Have students generalize a rule for lighting the bulb. (ESR: Metal must be touching metal. The base of the light bulb must touch the metal cap of the battery and the wire.) |
| **Elaborate** | Have students recall how they were able to light the bulb. Facilitate a class discussion that leads students to recall that to light the bulb metal must touch metal. Distribute a copy of the Insulators and Conductors Activity Sheet to each group. Have students make a prediction about whether an item given on the sheet will allow electricity to flow, i.e., a conductor; or will not allow electricity to flow, i.e., an insulator. Have students circle their predictions.Using the materials for construction of a simple circuit distribute to each group a bulb holder and second wire to make a complete circuit. Distribute a plastic zip-top bag with the items to be tested by each group i.e., eraser, metal pen, paper envelope, paper clip, pencil, piece of chalk (small), penny, spoon, nail. Model how to place items to be tested in the circuit. Have students test each of the items by using the simple circuit to see which of the items light the bulb. Have students use a different colored pencil to circle their actual results on the Insulators and Conductors Activity Sheet. Share results. Ask students to examine their observations to find out what the conductors/insulators have in common. (ESR: Conductors are made of metal. Insulators are not made of metal.) Ask students to think about how they found out whether an item was a conductor or an insulator. (ESR: Conductors lit the bulb. Insulators did not light the bulb.)Have students think about other materials they would like to test to find out if they are conductors or insulators. Have students construct a “T-chart” in their science notebooks labeled: Insulators and Conductors. Have students use their simple circuit to test other materials in the classroom. Remind students to record their observations on their chart in their science notebooks. |
| **Evaluate** | * Have students think about the diagrams they drew of their complete, simple circuits from before. Explain, if they added another piece of wire, light bulb and bulb holder to their simple circuit this would make a series circuit. Ask, “What do you think would happen if one light bulb is unscrewed from its holder. (ESR: Both lights will go out. The remaining light will stay lit.)
* Explain, A series circuit is a simple circuit. If one light bulb goes out in a series circuit, all bulbs will go out because the only path for electricity to travel has been interrupted. Have students explain in their notebooks why both lights go out in series circuit when one light bulb is unscrewed. (ESR: The electricity has only one path to follow. When one light bulb is unscrewed, the path for the electricity is interrupted and the other bulb goes out.)
* Have students draw a series circuit in their science notebook it should have 2 light bulbs, a power source (D-Cell), and wire.
* Have students look closely at a piece of insulated wire. Ask students, “What do you notice about the wire?” (ESR: The wire is made of plastic and metal.)
* Have students list other items in their science notebook that are made of both an insulator and a conductor.
* Post Test
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**Insulators and Conductors Activity Sheet**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Which of the following items are more likely conductors or insulators? Circle your prediction.

