Explaining the relationships or interactions between events and ideas will help you develop a deeper understanding of scientific or technical texts.

Read  When you read **scientific texts**, you learn about the natural world. If you read about why lightning strikes or how electricity works, you’re reading a scientific text. When you read **technical texts**, you are learning to make or do something. If you read the directions for using a cell phone, you are reading a technical text. Both scientific and technical texts describe the **relationships** and **interactions** between events, ideas, or concepts.

Read the passage. Underline any relationships or details that seem important.

**ELECTRICITY IN MOTION**

You’re pretty familiar with what electricity can do. You flip a switch and a light bulb glows. You push a button and a fan whirs to life. Turning on an electric oven makes it heat up. But why do you get these results? What do a glowing light bulb, a spinning fan, and a hot oven have in common?

The answer is current electricity, or the steady flow of bits of matter called electrons. You can’t see electrons. They’re so small that even the best microscopes won’t show one to you. But while electrons aren’t visible, you can see the effects of their motion. Light bulbs, fans, ovens—all of these work because you’ve let the electrons flow.
Think  Consider what you know about scientific and technical texts. What process does the passage describe? How does one event lead to another? Complete the organizer, and then write a short explanation of what you learned about electricity.

Event 1
You flip a light switch.

Event 2

Event 3

Explanation of the Process


Talk  Share your explanation with a partner.

• What events do you include in your organizer?
• What kind of relationships do you see between one event and another?
• How does understanding one event help you understand another event?

Academic Talk
Use these words and phrases to talk about the text.

• relationship
• interaction
• scientific text
• technical text
Electricity and Batteries

by Nicole S. Slate

1. Electricity powers our smartphones, music players, and other devices. Where does the electricity for these small machines come from? Batteries, of course. But who invented the battery? And what did a battery teach us about the relationship between electricity and magnetism?

2. Let’s begin with the invention of the battery. In 1799, scientists didn’t know much about electricity. When faced with the unknown, scientists get curious—and Alessandro Volta was curious, indeed. Volta discovered that he could produce electricity by dipping two different metals (such as zinc and copper) into a glass of salt water. He experimented further. First, he soaked small pieces of cardboard in salt water. Next, he sandwiched one piece of soaked cardboard between a copper disk and a zinc disk. Finally, he stacked several such sandwiches into a pile. When Volta attached a wire to the top and bottom of the pile, electricity flowed through the wire. The first battery was born.

3. In the following years, scientists made more discoveries about electricity. One of the most startling of these came in 1820. In that year, the scientist Hans Oersted (UR-stead) observed that a compass needle will move when brought near a wire hooked to a battery. Oersted, knowing that compass needles respond to magnets, realized that electric currents produce magnetic fields. Oersted’s recognition that electricity and magnetism are related was one of the most important discoveries of nineteenth-century science.

4. Today, batteries, electricity, and magnetism are so common that you probably don’t give them a second thought. But to people of 1799 and 1820, Volta’s and Oersted’s discoveries were magical. If you ever get the chance to build a battery and use it to generate a magnetic field, you might experience a bit of that old magic for yourself.
Think

1. Complete this organizer for the important events in paragraphs 2 and 3.

Event 1
Volta put small pieces of cardboard between disks of copper and zinc and stacked several of them together.

Event 2

Event 3

Talk

2. Share your organizers. Discuss the events you describe and how they are related. Revise your organizers as necessary.

Write

3. **Short Response** Explain how Volta’s discovery led to Oersted’s discovery. Use details from the text to support your answer. Use the space provided on page 58 to write your answer.
This experiment tells how to make a battery similar to the one Alessandro Volta made. The chemical reaction of salt and vinegar in the presence of copper and zinc makes electricity flow through a wire.

**BATTERY POWER**

by Gary Gibson, in *Science for Fun Experiments*

1. Find 12 copper coins and zinc washers of similar size. They will need to be stacked. Cut out 12 same-sized circles of blotting paper.
2. Pour vinegar into a glass with a tablespoonful of salt. Soak each piece of blotting paper in the mixture. Stack a coin, then a washer, on a piece of blotting paper. Finish with a washer.
3. Take 6½ feet of thin plastic-coated copper wire. Coil it tightly around an iron nail as many times as you can.
4. Attach one end of the copper wire to the bottom coin and the other to the top washer.
5. Test your battery by bringing the nail close to a small compass. The nail should make the compass needle swing.

**Why It Works**

The salt and vinegar start a chemical reaction. Negatively charged particles flow through coins to the washers, around the wire coil, and back to the battery. The electric current creates a magnetic field that affects a compass needle.

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1 The negatively charged particles are bits of matter called electrons.
Think  Use what you learned from reading the technical text to respond to the following questions.

1  This question has two parts. Answer Part A. Then answer Part B.

   Part A
   Which statement best describes how an electric current affects a compass?
   
   A  The electric current goes from the wire into the compass.
   B  The electric current works only with thin copper wire.
   C  The electric current makes the compass needle move.
   D  The electric current causes the nail to swing near the compass.

   Part B
   Which two sentences best show the relationship made in Part A?
   
   A  “Pour vinegar into a glass with a tablespoonful of salt.”
   B  “Coil it tightly around an iron nail as many times as you can.”
   C  “Attach one end of the copper wire to the bottom coin and the other to the top washer.”
   D  “The nail should make the compass needle swing.”
   E  “The salt and vinegar start a chemical reaction.”
   F  “The electric current creates a magnetic field that affects a compass needle.”

Talk

2  Reread the steps to make and test the battery. Why is it important to follow the steps in the order? What would happen if you didn’t, or if you used different materials? Write notes from your discussion.

Write

3  Short Response  Explain why it is important to follow the steps in order and use the proper materials. Use details from the text to support your answer. Use the space provided on page 59 to write your answer.

HINT  Don’t just describe the steps and materials. Explain why the steps and specific materials are necessary.
Electricity and Batteries

3 Short Response Explain how Volta’s discovery led to Oersted’s discovery. Use details from the text to support your answer.

Don’t just describe what Volta and Oersted discovered. Explain how Oersted’s discovery depended on Volta’s.

Write Use the space below to write your answer to the question on page 55.
BATTERY POWER

Short Response Explain why it is important to follow the steps in order and use the proper materials. Use details from the text to support your answer.

HINT Don’t just describe the steps and materials. Explain why the steps and specific materials are necessary.

Check Your Writing

☐ Did you read the prompt carefully?
☐ Did you put the prompt in your own words?
☐ Did you use the best evidence from the text to support your ideas?
☐ Are your ideas clearly organized?
☐ Did you write in clear and complete sentences?
☐ Did you check your spelling and punctuation?
So just how do we get electricity from water? Actually, hydroelectric and coal-fired power plants produce electricity in a similar way. In both cases, a power source is used to turn a propeller-like piece called a turbine. The turbine then turns a metal shaft in an electric generator. The generator is the motor that produces electricity. A coal-fired power plant uses steam to turn the turbine blades. A hydroelectric plant uses falling water to turn the turbine. The results are the same.
A typical hydroelectric dam is built on a large river with a large drop in elevation. The dam stores lots of water behind it in the reservoir. Near the bottom of the dam wall there is the water intake called a penstock. Gravity causes the water to fall through the penstock inside the dam. At the end of the penstock, there is a turbine propeller, which is turned by the moving water. The shaft from the turbine goes up into the generator, which produces the power.\(^1\) Power lines connected to the generator carry electricity to your home and mine. The water continues past the propeller through the tailrace. The water then flows into the river, past the dam. By the way, it is not a good idea to be playing in the water right below a dam when water is released!

\(^1\) For the generator to produce electricity, loops of wire must spin rapidly through force fields made by magnets.
Pumped Storage: Reusing Water for Peak Electricity Demand

3 Demand for electricity is not “flat” and constant. Demand goes up and down during the day. Overnight there is less need for electricity in homes, businesses, and other facilities. For example, at 5:00 PM on a hot August weekend day, there may be a huge demand for electricity to run millions of air conditioners! But, 12 hours later at 5:00 AM . . . not so much. Hydroelectric plants are more efficient at providing for peak power demands during short periods than are fossil fuel and nuclear power plants. One way of doing that is by using “pumped storage,” which uses the same water more than once.

4 Pumped storage is a method of keeping water in reserve for peak periods of power demand. Pumps move water that had already flowed through the turbines back up to a storage pool above the power plant. That happens when customer demand for energy is low, such as during the middle of the night. The water is then allowed to flow back through the turbine-generators at times when electricity demand is high.
Think  Use what you learned from reading the technical text to respond to the following questions.

1. The boxes below describe four events from “Hydroelectric Power.” Two events are causes, one event is an effect, and one event results from that effect. The events are in no particular order.

Water is stored in response to changing demand.  
People use more electricity in the day.  
The demand on a power plant changes over time.  
Electricity use drops at night.

Complete the diagram below by copying each event in the correct box.

2. Which sentence describes a way hydroelectric plants are better than other power plants?
   
   A. “Actually, hydroelectric and coal-fired power plants produce electricity in a similar way.”
   B. “A typical hydroelectric dam is built on a large river with a large drop in elevation.”
   C. “Overnight there is less need for electricity in homes, businesses, and other facilities.”
   D. “Hydroelectric plants are more efficient at providing for peak power demands during short periods than are fossil fuel and nuclear power plants.”
This question has two parts. First, answer Part A. Then answer Part B.

**Part A**
Select the statement that best describes how water produces electricity.

- **A** Water is stored during periods when electricity is not needed.
- **B** A coal-fired power plant turns steam into electricity.
- **C** Moving water turns a turbine within a generator.
- **D** A penstock is needed to create electricity from water.

**Part B**
Which two sentences from the text best show the relationship described in Part A?

- **A** “Actually, hydroelectric and coal-fired power plants produce electricity in a similar way.”
- **B** “The generator is the motor that produces electricity.”
- **C** “A hydroelectric plant uses falling water to turn the turbine.”
- **D** “A typical hydroelectric dam is built on a big river with a large drop in elevation.”
- **E** “Power lines connected to the generator carry electricity to your home and mine.”
- **F** “Pumps move water that had already flowed through the turbines back up to a storage pool above the power plant.”

**4**
Read the sentence from the text.

The turbine then turns a metal shaft in an electric generator.

Which dictionary entry best defines turbine?

- **A** a natural force that causes things to fall
- **B** a gate for regulating the flow of water
- **C** an engine with a part that turns like a wheel
- **D** a machine for carrying things to different levels in a building
Learning Target

In this lesson, you practiced explaining the relationships and interactions between events and ideas in scientific and technical texts. Explain how your work has prepared you to read other scientific or technical texts.

Write

5 Short Response  Explain the role that gravity plays in a hydroelectric dam’s ability to produce electricity. Use details from the text to support your answer.

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