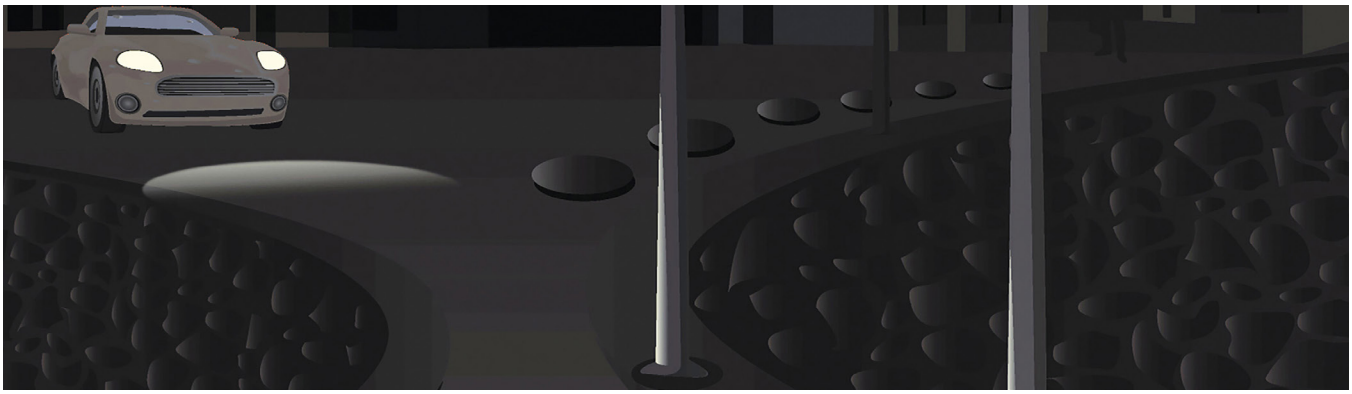
AmplifyScience



Energy Conversions:

Blackout in Ergstown

Investigation Notebook

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Amplify Science Elementary is based on the *Seeds of Science/Roots of Reading*® approach, which is a collaboration between a science team led by Jacqueline Barber and a literacy team led by P. David Pearson.

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Grade 4
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Safety Guidelines for Science Investigations

1. **Follow instructions.** Listen carefully to your teacher's instructions. Ask questions if you don't know what to do.
2. **Don't taste things.** No tasting anything or putting it near your mouth unless your teacher says it is safe to do so.
3. **Smell substances like a chemist.** When you smell a substance, don't put your nose near it. Instead, gently move the air from above the substance to your nose. This is how chemists smell substances.
4. **Protect your eyes.** Wear safety goggles if something wet could splash into your eyes, if powder or dust might get in your eyes, or if something sharp could fly into your eyes.
5. **Protect your hands.** Wear gloves if you are working with materials or chemicals that could irritate your skin.
6. **Keep your hands away from your face.** Do not touch your face, mouth, ears, eyes, or nose while working with chemicals, plants, or animals.
7. **Tell your teacher if you have allergies.** This will keep you safe and comfortable during science class.
8. **Be calm and careful.** Move carefully and slowly around the classroom. Save your outdoor behavior for recess.
9. **Report all spills, accidents, and injuries to your teacher.** Tell your teacher if something spills, if there is an accident, or if someone gets injured.
10. **Avoid anything that could cause a burn.** Allow your teacher to work with hot water or hot equipment.
11. **Wash your hands after class.** Make sure to wash your hands thoroughly with soap and water after handling plants, animals, or science materials.

What Is a Design Argument?

1. It answers a question with a claim about which solution best meets the criteria.
2. It connects evidence to each of the criteria. Evidence can be:
    - data or information from testing
    - ideas from texts and experiences
3. It describes any limitations.
4. It is written for an audience.
5. It uses scientific language.

Name: _____ Date: _____

Getting Ready to Read: *Systems*

1. Before reading the book *Systems*, read the sentences below.
2. If you agree with a sentence, write an "A" on the line before the sentence.
3. If you disagree with a sentence, write a "D" on the line before the sentence.
4. After you read the book, return to this page and read the sentences again. Decide whether your ideas have changed. Be ready to explain your thinking.

_____ Systems can have just a few parts or many parts.

_____ When a system changes, it always breaks.

_____ Systems do not interact with other systems.

_____ Parts of a system help the system perform its function.

_____ A system can be part of another larger system.

Name: _____ Date: _____

Reading Reflection: *Systems*

1. Read each question below.
2. Use what you read in *Systems* to help you answer each question.
3. Use **ideas** from the text to support your thinking.

If a change is made to a system, does that mean the system will fail? Why or why not?

_____

_____

_____

_____

Why do you think it's important for scientists and engineers to think about systems?

_____

_____

_____

_____

Make a list of as many systems as you can think of. Try to think of examples that were not described in the book *Systems*.

_____

_____

_____

_____

Name: _____ Date: _____

Multiple Meaning Words

Some words can mean more than one thing. For each word in the chart:

1. Read the sentence from the book *Systems* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

Word	**Sentence from the book**	**Meaning 1**	**Meaning 2**
part	A wheel is just a **part** of a bicycle.	when things move away from each other	a piece of something such as an object, activity, or period of time
light	These parts all have different functions: . . . the windows let in **light** but keep out cold air. . . .	not heavy	something that makes things visible
cold	Homes in **cold** places have a system for heating.	low temperature	a common sickness
switches	A home electrical system has wires, outlets for plugging devices in, and **switches** for turning the electricity on and off.	to change position or direction	a device for making and breaking the connection in an electric circuit

Name: _____ Date: _____

Daily Written Reflection

Think about a system that you have at home. What is the system's function and what are the system's parts?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Building a Simple Electrical System

1. With your group, use a solar panel, a fan, and two wires to build an electrical system that functions. (The fan will spin when it functions.)
2. Predict what you can do to make the fan spin more quickly or slowly. Test your ideas, and then discuss what caused the fan to spin more quickly or slowly.
3. Predict what you can do to make the fan spin in a different direction. Test your ideas, and then discuss what caused the fan to spin in a different direction.
4. In the space below, draw your functioning system. Be sure to label every part. (Hint: In order to function, the system needs one part that was not included in your bag of materials.)

Name: _____ Date: _____

Text Features Scavenger Hunt

1. Look through *Systems* to find an example of each of the text features in the left column of the table.
2. Record the page number where that text feature can be found.
3. Write a brief description of the text feature.
4. Explain what the text feature helps you understand.

Text feature	**Page**	**Description**	**This helps me understand . . .**
Title	cover	*Systems* (the name of the book)	The book will be about different systems.
Table			
Glossary			
Bold word			

Name: _____ Date: _____

Text Features Scavenger Hunt (continued)

Text feature	Page	Description	This helps me understand . . .
Heading			
Image (drawing, diagram, or photo)			
Caption			
Table of contents			

Name: _____ Date: _____

Parts of a System

1. With your partner, look through *Systems* and choose one of the systems described in the book.
2. Write the name of the system and its function on the two lines below.
3. Record each part of the system in the left column of the table below.
4. Beside each part, record the part's function.
5. Use as many rows as you need.

_____ System

Function: _____

Part	**Function**

Name: _____ Date: _____

Daily Written Reflection

Name five things at home or at school that use electrical energy. Explain how you know.

_____

_____

_____

_____

_____

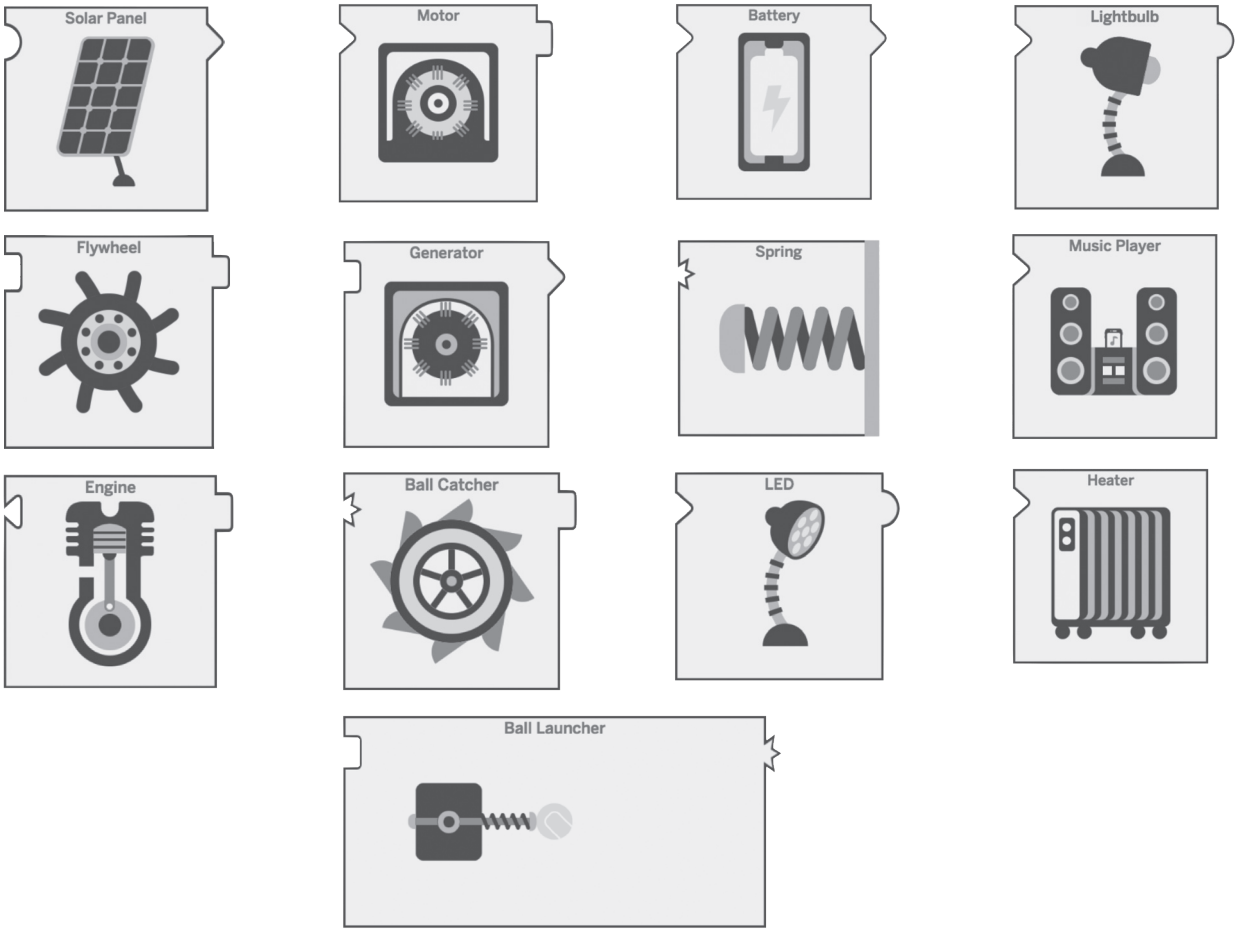
_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Electrical Energy in the *Energy Conversions* Sim

1. Circle each device you find in the *Energy Conversions* Sim that has electrical energy as an energy input.
2. Make an "X" across each device that does not have electrical energy as an energy input.



How can you tell if a device in the Sim is using electrical energy?

_____

_____

_____

Name: _____ Date: _____

Daily Written Reflection

Where do you see evidence of energy in your everyday life?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Synthesizing Ideas About Forms of Energy

1. Think about what you have learned about energy forms from the reference book and your experiences building simple electrical systems.
2. Record your ideas in the first two boxes.
3. Then, put the ideas together. Write a new understanding in box below the arrow.

Idea:

Source: *It's All Energy*

Idea:

Source: Building simple electrical systems

New understanding:

Name: _____ Date: _____

Daily Written Reflection

List any electrical devices you can think of that have sound energy as an output.

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Forms of Energy in the Subway

Look at the picture of the Ergstown subway on page 17. Name at least two forms of energy that you see evidence of. What is your evidence?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____ Date: _____

Forms of Energy in the Subway (continued)

Name: _____ Date: _____

Writing an Argument About the Blackout

1. Read the question and circle the claim that you think best answers the question.
2. Circle the sources of your evidence.
3. Write your evidence in the space provided.

Question:

What happened to the electrical system the night of the Ergstown blackout?

Claim: (Circle one.)

All the lights in the electrical system broke.

Something went wrong with the electrical system.

Sources of Evidence: (Circle each one you will use.)

Energy Conversions Simulation

It's All Energy reference book

Simple Electrical System (the one you built)

images of Ergstown before and during the blackout

What is your evidence?

_____

_____

_____

_____

Name: _____ Date: _____

Writing an Argument About the Blackout (continued)

Name: _____ Date: _____

Chapter 1: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists and engineers investigate in order to figure things out. Am I getting closer to figuring out a design that improves Ergstown's electrical system?

I understand why a device might not work. _____ Yes _____ Not yet

I understand what happens when a device is plugged in. _____ Yes _____ Not yet

I understand where energy in a system comes from. _____ Yes _____ Not yet

I understand what happens when there is not enough energy in a system. _____ Yes _____ Not yet

I understand what happens when there are too many devices in a system. _____ Yes _____ Not yet

I understand why the lights went out in Ergstown. _____ Yes _____ Not yet

I understand that science affects everyday life. _____ Yes _____ Not yet

What about the blackout in Ergstown or energy are you still wondering?

_____

_____

_____

_____

Name: _____ Date: _____

Daily Written Reflection

Think of five electrical devices that you use the most at home, at school, or other places. What are the output energy forms of those devices? (Example: I use light energy from overhead lights.)

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Energy Input and Output Table

1. Read the Electrical Devices section in *It's All Energy*. Use information from the book to complete the table below.
2. Record each electrical device you read about in the first column.
3. Next to each device, record its function (in the second column), its input energy form (in the third column), and its output energy form (in the fourth column).

Device	Function	Input energy form	Output energy form

Name: _____ Date: _____

Observing Energy Conversions in the Sim

1. Build and run a system in the Sim with **light as an output energy form**.
2. Think of a name for your system. Record it in the first column below.
3. In the same row, record the system's parts, an electrical device in the system, and the output energy form (or forms) of that device.
4. Build and run a system in the Sim with **sound as an output energy form**.
5. Repeat steps 2 and 3 to complete the bottom row of the table.

System name	Parts	Electrical device	Output energy

Name: _____ Date: _____

Daily Written Reflection

When you clap your hands, you are converting motion energy to sound energy. Can you think of other things you do that have sound energy, motion energy, or thermal energy as energy outputs?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Getting Ready to Read: *Energy Past and Present*

1. Before reading the book *Energy Past and Present*, read the sentences below.
2. If you agree with a sentence, write an "A" on the line before the sentence.
3. If you disagree with a sentence, write a "D" on the line before the sentence.
4. After you read the book, return to this page and read the sentences again. Decide whether your ideas have changed. Be ready to explain your thinking.

_____ Devices convert electrical energy into other forms of energy.

_____ Today people use electrical devices to do many of the same things that people did before electrical devices existed.

_____ People could not take hot baths in the past, because there was no electricity.

_____ Light, sound, motion, and thermal energy were all available in the past.

_____ We can't learn anything about saving electrical energy from the people who lived in the past.

Name: _____ Date: _____

Reading Reflection: *Energy Past and Present*

1. Read each question below.
2. Use what you read in *Energy Past and Present* to help you answer each question.
3. Use evidence from the text to support your thinking.

Imagine you lived in the past. What would you use to help you see at night? What energy form is being converted and what is it being converted to?

_____

_____

_____

Think of an electrical device that you use to do something. Explain how you could use another kind of energy besides electrical energy to do the same thing. (For example, you could use the sun's energy to dry your clothes.)

_____

_____

_____

_____

What is the function of electrical devices in an electrical system? Choose one electrical device that you read about in the book and explain its function.

_____

_____

_____

_____

Name: _____ Date: _____

Multiple Meaning Words

Some words can mean more than one thing. For each word in the chart:

1. Read the sentence from *Energy Past and Present* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

Word	**Sentence from the book**	**Meaning 1**	**Meaning 2**
run	Every day we use electrical energy to **run** so many different devices . . .	to move at a speed faster than a walk	to work
form	These devices all convert electrical energy into other **forms** of energy. . .	a type or kind	a document with spaces in which to record information
cool	To keep **cool** when it's hot, people run electric fans and air conditioners.	to be impressive	of a low temperature
plant	. . . wires transfer electrical energy from a power **plant** to the fan in your house.	a living organism that needs water, sunlight, and carbon dioxide	a station

Name: _____ Date: _____

Synthesizing Ideas About Converting Energy

1. Read the question below. As you read *Energy Past and Present*, look for ideas in the text that will help you answer the question.
2. Record ideas from the text in the boxes below. Include page numbers.
3. Then, with your class, connect the ideas together to answer the question. Write your new understanding in the box below the arrow.

Question: How do devices have so many different output energy forms when they are plugged into the same electrical system?

Idea: Page:
Idea: Page:
Idea: Page:
Idea: Page:

New understanding:

Name: _____ Date: _____

Daily Written Reflection

What is one way that you have worked as a systems engineer in this unit?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Energy Output from a Hair Dryer

1. Look at the image of the hair dryer.
2. Then use what you have learned to answer the questions below.

A hair dryer is a device that blows hot air to dry people's wet hair. Think about the hair dryer's output energy. This energy form is called

_____

_____.

How did it become that energy form?

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____ Date: _____

Roundtable Discussion

1. With your group, assign Discussion Leader numbers from 1 to 4.
2. Discussion Leader 1 will ask the first Discussion Question and lead the group's discussion. The Discussion Leader may ask any of the Follow-up Questions to keep the discussion going.
3. Take turns asking questions until all four group members have had a turn leading the discussion.
4. Be ready to share your group's thinking with the class.

Discussion Questions:

Discussion Leader 1: Do you think the City Planner's solutions make sense? Why or why not?

Discussion Leader 2: How do you think the people of Ergstown will feel if they have to stop using some devices? Why do you think that?

Discussion Leader 3: How do you think the people of Ergstown will feel about having the town install more LED lights to replace older lights? Why do you think that?

Discussion Leader 4: Which solution do you think best meets the criteria?

Follow-up Questions:

- What do you think?
- Why do you think so?
- Does anyone have a different idea?
- Do you agree or disagree? Why?

Name: _____ Date: _____

Daily Written Reflection

What are some ways that you save energy at home? At school?

_____

_____

_____

_____

_____

_____

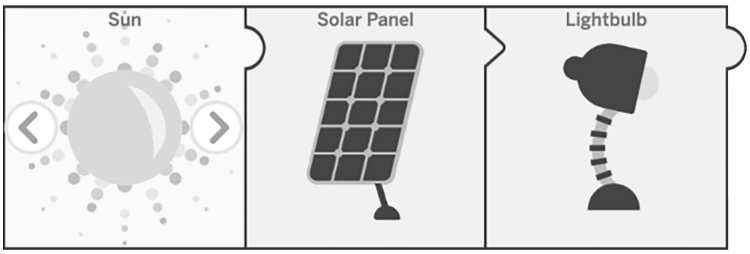
Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Gathering Evidence in the Sim

1. In the *Energy Conversions* Sim, set up each energy system shown below.
2. After you build each system, change the amount of energy transferred in so that **at least 10 units of light energy** are transferred out of the system.
3. For each system, record the amount of energy transferred in and the amount of light, thermal, and sound energy transferred out.
4. Use what you learn to answer the questions at the bottom of page 34.

Test 1:

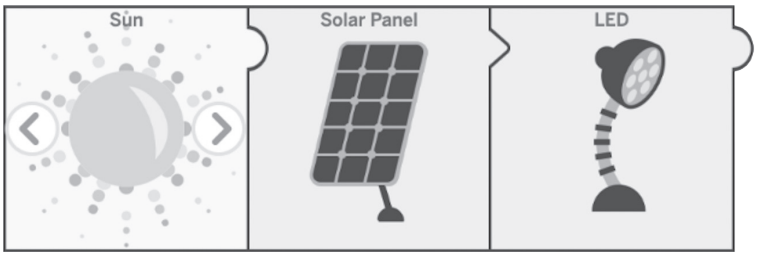


Energy transferred in: _____

Energy transferred out:

Light: _____ Thermal: _____ Sound: _____

Test 2:



Energy transferred in: _____

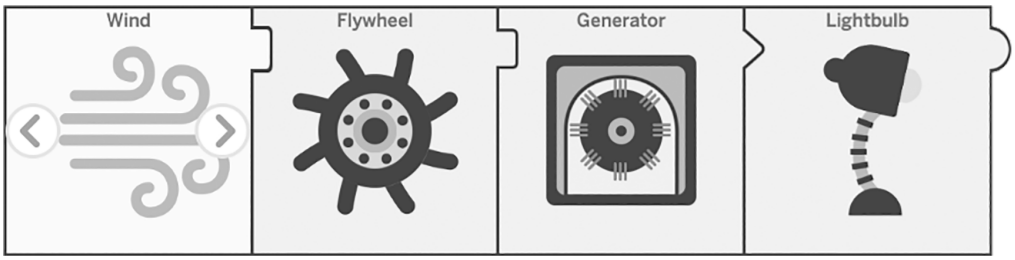
Energy transferred out:

Light: _____ Thermal: _____ Sound: _____

Name: _____ Date: _____

Gathering Evidence in the Sim (continued)

Test 3:

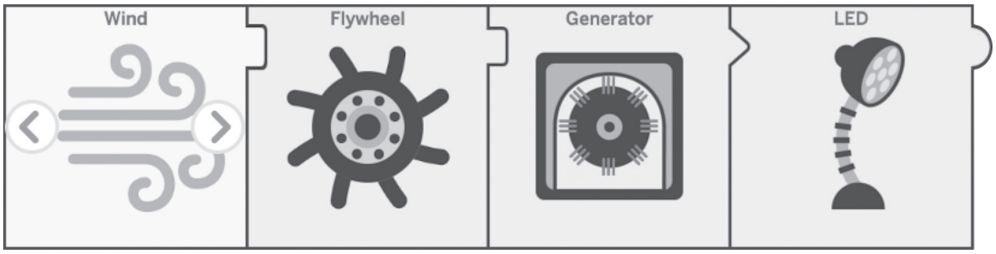


Energy transferred in: _____

Energy transferred out:

Light: _____ Thermal: _____ Sound: _____

Test 4:



Energy transferred in: _____

Energy transferred out:

Light: _____ Thermal: _____ Sound: _____

What happened when you switched from lightbulbs to LEDs?

_____

Will Ergstown use less energy by replacing streetlight lightbulbs with LEDs?

_____

_____

_____

Name: _____ Date: _____

Gathering Evidence from *It's All Energy*

1. Think about the claim you want to support.
2. Look through *It's All Energy* for evidence that will support that claim.
3. Record the evidence you find, along with each page where you found it.

_____

_____

_____

_____

_____

_____

_____

Name: _____ Date: _____

Design Argument About Reducing the Number of Blackouts in Ergstown

1. Read the question and the two possible solutions.
2. Read the criteria and think about which solution will best meet them.
3. Write a claim that answers the question.
4. Record your evidence. Explain how your evidence shows that the solution meets all of the criteria.

Question:

Which is the best solution for reducing the number of blackouts in Ergstown?

Possible solutions:

Get people to stop using some devices.

Replace older streetlights with LED streetlights.

Criteria:

Converts less energy from the grid. (Uses less energy.)

Doesn't change how people use their devices.

_____

_____

_____

_____

_____

_____

_____

Name: _____ Date: _____

Design Argument About Reducing the Number of Blackouts in Ergstown (continued)

Name: _____ Date: _____

Chapter 2: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists and engineers investigate in order to figure things out. Am I getting closer to figuring out a design that improves Ergstown's electrical system?

I understand why a device might not work. _____ Yes _____ Not yet

I understand what happens when a device is plugged in. _____ Yes _____ Not yet

I understand where energy in a system comes from. _____ Yes _____ Not yet

I understand what happens when there is not enough energy in a system. _____ Yes _____ Not yet

I understand what happens when there are too many devices in a system. _____ Yes _____ Not yet

I understand why the lights went out in Ergstown. _____ Yes _____ Not yet

I understand that science affects everyday life. _____ Yes _____ Not yet

What about the blackout in Ergstown or energy are you still wondering?

_____

_____

_____

_____

Name: _____ Date: _____

Daily Written Reflection

All the devices in your house stopped working suddenly. What do you think is the problem? Why?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Light the LED

1. With your partner, use the *Energy Conversions* Simulation to build several different systems. Each system should include no more than six parts and one part must be an LED.
2. Select one of the systems that you build.
3. In the table below, list each of the parts of that system in order—use only as many boxes as you need. (Hint: The part under the number 1 should be the part of the system that you selected by tapping the circle in the Sim.)
4. Then answer the question.

Parts of the System					
1	**2**	**3**	**4**	**5**	**6**

In the system you built, where did the energy come from?

_____

Name: _____ Date: _____

Synthesizing Ideas About Energy Sources

1. Read pages 28–33 in the Energy Sources section of *It's All Energy.*
2. After you read about each energy source, think about how ideas from the book are connected to what you observed in the Sim.
3. Record your ideas in the table below.
4. Read pages 34–41 in *It's All Energy*.

Energy source	Ideas from the Book and the Sim
fossil fuels	
wind	
sun	

What new understanding do you have about Ergstown's electrical system?

_____

_____

_____

Name: _____ Date: _____

Scientific Language for Synthesizing

On page _____ of the book, I read _____.

I also observed _____.

When I read about _____ it made me think that _____.

Based on _____, I can conclude that _____.

Because of _____, I now think that _____.

This idea is important because _____.

Name: _____ Date: _____

Daily Written Reflection

What new ideas do you have about energy sources?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

You can use this page to record notes or create drawings.

Name: _____ Date: _____

Daily Written Reflection

Pick one energy source and describe what type of converter you would use to convert that form of energy into electrical energy. Then write about one benefit of using that source of energy.

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Getting Ready to Read: *Sunlight and Showers*

1. Before reading the book *Sunlight and Showers*, read the sentences below.
2. If you agree with a sentence, write an "A" on the line before the sentence.
3. If you disagree with a sentence, write a "D" on the line before the sentence.
4. After you read the book, return to this page and read the sentences again. Decide whether your ideas have changed. Be ready to explain your thinking.

_____ Light energy can be used to kill germs in water.

_____ Things become warmer in sunlight because the light energy is converted into thermal energy.

_____ Engineers do not have to test their ideas.

_____ Solar energy can be used to make water hot.

_____ Engineers often work together to solve problems in the world.

Name: _____ Date: _____

Reading Reflection: *Sunlight and Showers*

1. Read each question below.
2. Use what you read in *Sunlight and Showers* to answer each question.
3. Use evidence from the text to support your thinking.

Choose one of these things that the students did during their design process. Explain what the students did and why you think it was important.

- Learn
- Find available materials
- Plan
- Test materials
- Synthesize findings
- Test the product

_____

_____

_____

_____

Look at page 11. What criteria did the students use in their design?

Criteria 1:_____

_____

Criteria 2:_____

_____

Criteria 3:_____

_____

Criteria 4:_____

_____

Name: _____ Date: _____

Reading Reflection: *Sunlight and Showers* (continued)

Draw a diagram of a shower that you would design for a community that gets little sun and where it often snows.

Name: _____ Date: _____

Multiple Meaning Words

Some words can mean more than one thing. For each word in the chart:

1. Read the sentence from *Sunlight and Showers* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

Word	**Sentence from the book**	**Meaning 1**	**Meaning 2**
rest	The students went back to the U.S. and shared their data with the **rest** of the team.	to relax	the remaining part
kind	They wanted to build the water heaters in Guatemala, so they found out what **kinds** of building materials are available there.	type	to be nice
holds	Professor Gadgil **holds** a glass of water that was cleaned by his machine.	to pause	to carry
shower	It's great to be able to take a hot **shower** whenever you want.	a little bit of rain	a bath in which water is sprayed on the body

Name: _____ Date: _____

School Backup Electrical Energy System

1. Imagine that your school is going to install a backup electrical system that can function during a blackout.
2. Decide what would be the best backup energy source to use. Be sure to consider things such as cost and whether the energy source is available in your area.
3. Then answer the questions below. Use evidence from the *It's All Energy* reference book.

What is the best backup energy source for your school?

_____

_____

How does the energy from the source become electrical energy?

_____

_____

_____

Why is this the best backup energy source for your school? Use evidence from the Energy Sources section (pages 26–41) of *It's All Energy* to help support your argument.

_____

_____

_____

_____

_____

Name: _____ Date: _____

Engineering Practices

1. Read *Sunlight and Showers.* As you read, complete the table below.
2. In the first column, record some of the engineering practices in the book.
3. In the second column, make connections between what engineers in the book do and your work as a systems engineer.
4. Then answer the question below the table.

What engineers do	**What we do**
Page:	
Page:	
Page:	
Page:	
Page:	

What new understanding do you have about what engineers do?

_____

_____

Name: _____ Date: _____

Daily Written Reflection

Which of the engineering practices described in *Sunlight and Showers* did you find the most interesting? Why?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Wind Turbine Criteria Checklist: First Design

1. Build your wind turbine.
2. Then read each of the criteria below.
3. Check each of the criteria that your wind turbine meets.

_____ **It spins as fast as possible.**

- Does your wind turbine spin when you blow on it or spin it with your hands?
- Does your wind turbine spin when it's in front of a fan?
- What can you change to make it spin faster?

_____ **It spins when the air moves slow and when it moves fast.**

- Does your wind turbine spin even when you blow on it gently?
- Does your wind turbine spin when it's in front of a fan on a low setting?
- Does your wind turbine spin when it's in front of a fan on a high setting?

_____ **It spins when the air blows from different directions.**

- Does your wind turbine spin when you blow on it from the front?
- Does your wind turbine spin when you blow on it from the side?
- Does your wind turbine spin when you hold it in front of a fan, facing the fan?
- Does your wind turbine spin when you hold it in front of a fan, facing a different direction?

Name: _____ Date: _____

Daily Written Reflection

What does your wind turbine do well? What would you like to improve about it?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Wind Turbine Criteria Checklist: Revised Design

1. Continue building your wind turbine. Make changes that you think will improve your design.
2. Then read each of the criteria below.
3. Check each of the criteria that your wind turbine meets.

_____ **It spins as fast as possible.**

- Does your wind turbine spin when you blow on it or spin it with your hands?
- Does your wind turbine spin when it's in front of a fan?
- What can you change to make it spin faster?

_____ **It spins when the air moves slow and when it moves fast.**

- Does your wind turbine spin even when you blow on it gently?
- Does your wind turbine spin when it's in front of a fan on a low setting?
- Does your wind turbine spin when it's in front of a fan on a high setting?

_____ **It spins when the air blows from different directions.**

- Does your wind turbine spin when you blow on it from the front?
- Does your wind turbine spin when you blow on it from the side?
- Does your wind turbine spin when you hold it in front of a fan, facing the fan?
- Does your wind turbine spin when you hold it in front of a fan, facing a different direction?

Name: _____ Date: _____

Designing a Wind Turbine

Draw a diagram of the wind turbine that your team designed. Include the energy source. Label each part of the system.

Wind Turbine System

Name: _____ Date: _____

Designing a Wind Turbine (continued)

In the table below, list each of the most important parts of your wind turbine system. Then describe the function of each part.

Part	Function

What is one design change that your team made after the peer review?

_____

_____

_____

Name: _____ Date: _____

Daily Written Reflection

What do you know about the design cycle? How did you use this process to build your wind turbine?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Roundtable Discussion

1. With your group, assign Discussion Leader numbers from 1 to 4.
2. Discussion Leader 1 will ask the first Discussion Question and lead the group's discussion. The Discussion Leader may ask any of the Follow-up Questions to keep the discussion going.
3. Take turns asking questions until all four group members have had a turn leading the discussion.
4. Be ready to share your group's thinking with the class.

Discussion Questions:

Discussion Leader 1: How well does installing solar panels meet the criteria?

Discussion Leader 2: How well does installing wind turbines meet the criteria?

Discussion Leader 3: Which criteria do you think would be the most important to meet very well?

Discussion Leader 4: Which solution do you think we should choose, based on the criteria?

Follow-up Questions:

- What do you think?
- Why do you think so?
- Does anyone have a different idea?
- Do you agree or disagree? Why?

Name: _____ Date: _____

Design Argument About Reducing Blackouts in Ergstown

1. Read the question and the two possible solutions.
2. Read the criteria and think about which solution will best meet them.
3. Think about the evidence you have been gathering and discussing with the class. Circle the sources of evidence you will use.
4. Write a claim that answers the question.
5. Support your claim with evidence.
6. Describe any limitations of the solution you chose.

Question:

Which is the best solution for reducing the number of blackouts in Ergstown?

Possible solutions: (Circle one.)

Install new solar panels.

Install new wind converters.

Criteria:

Increases the amount of energy in the electrical system.
Isn't too expensive.
Is safe for the environment.

Sources of evidence: (Circle the ones you use.)

designing a wind converter

building a simple electrical system with a solar panel

It's All Energy

Energy Conversions Simulation

Climate Report

Name: _____ Date: _____

Design Argument About Reducing Blackouts in Ergstown

(continued)

Name: _____ Date: _____

You can use this page to record notes or create drawings.

Name: _____ Date: _____

Chapter 3: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists and engineers investigate in order to figure things out. Am I getting closer to figuring out a design that improves Ergstown's electrical system?

I understand why a device might not work. _____ Yes _____ Not yet

I understand what happens when a device is plugged in. _____ Yes _____ Not yet

I understand where energy in a system comes from. _____ Yes _____ Not yet

I understand what happens when there is not enough energy in a system. _____ Yes _____ Not yet

I understand what happens when there are too many devices in a system. _____ Yes _____ Not yet

I understand why the lights went out in Ergstown. _____ Yes _____ Not yet

I understand that science affects everyday life. _____ Yes _____ Not yet

What about the blackout in Ergstown or energy are you still wondering?

_____

_____

_____

_____

Name: _____ Date: _____

Daily Written Reflection

What have you learned about how systems work? What do you think might happen if one part of a system isn't working?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Getting Ready to Read: *Blackout!*

1. Before reading the book *Blackout!*, read the sentences below.
2. If you agree with a sentence, write an "A" on the line before the sentence.
3. If you disagree with a sentence, write a "D" on the line before the sentence.
4. After you read the book, return to this page and read the sentences again. Decide whether your ideas have changed. Be ready to explain your thinking.

_____ In a blackout, lights do not work, but other electrical devices do.

_____ Blackouts can happen when people use a lot of electrical energy.

_____ Blackouts can last an hour or many days.

_____ Blackouts are always caused by bad weather.

_____ Every blackout is caused by failure of the electrical grid.

Name: _____ Date: _____

Reading Reflection: *Blackout!*

1. Read each question below.
2. Use what you read in *Blackout!* to answer each question.
3. Use evidence from the text to support your thinking.

What are some of the causes of blackouts?

_____

_____

_____

_____

How can a heat wave cause a blackout?

_____

_____

_____

_____

_____

_____

Choose one blackout that you read about. Record the title and page number below. Then, answer the question on the next page.

Article title: _____

_____

Page: _____

Name: _____ Date: _____

Reading Reflection: *Blackout!* (continued)

What would you recommend the people who live in the area of the blackout do to prevent blackouts in the future? Why?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Multiple Meaning Words

Some words can mean more than one thing. For each word in the chart:

1. Read the sentence from *Blackout!* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

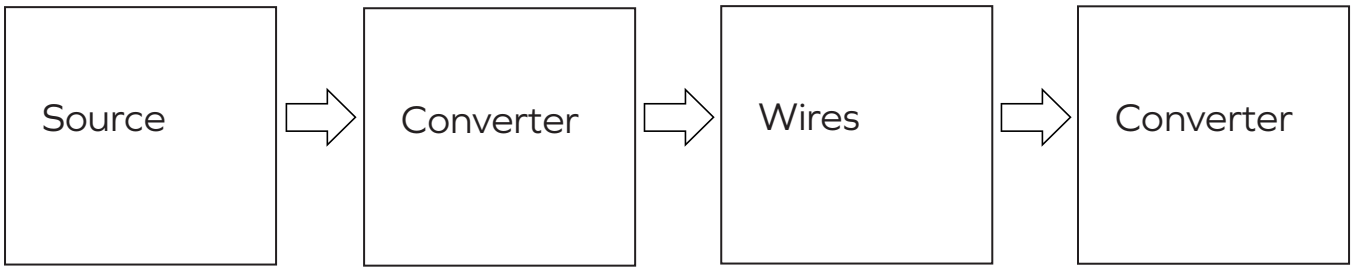
Word	**Sentence from the book**	**Meaning 1**	**Meaning 2**
article	This book is a collection of **articles** about failures in the electrical system.	a piece of writing on a subject that is included in a magazine, newspaper, etc.	an individual object (such as an article of clothing)
rolling	Heat Wave Leads to **Rolling** Blackouts.	to move on wheels	continuing in a series of stages
plant	Coal shortages have shut down several big power **plants**.	an herb or other small vegetable growth	a building or factory where something is made
power	Millions Without Power After Hurricane Sandy.	the ability to control people or things	to supply a device with electrical energy

Name: _____ Date: _____

Parts of the System That Failed: Simple Electrical System

1. Write about the simple electrical system that you observed. Which part or parts of the simple electrical system failed? Circle that part or parts.
2. Explain your response in the space below.
3. Explain what caused the system to function when you made a change.

Simple Electrical System



What evidence makes you think this?

_____

_____

_____

_____

_____

_____

What caused the system to function when you made a change?

_____

_____

_____

Name: _____ Date: _____

Daily Written Reflection

Think of a system that includes these parts: the sun, a solar panel, wires, and a lamp. Describe two possible ways that you could make this system fail and explain why each failure would occur.

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

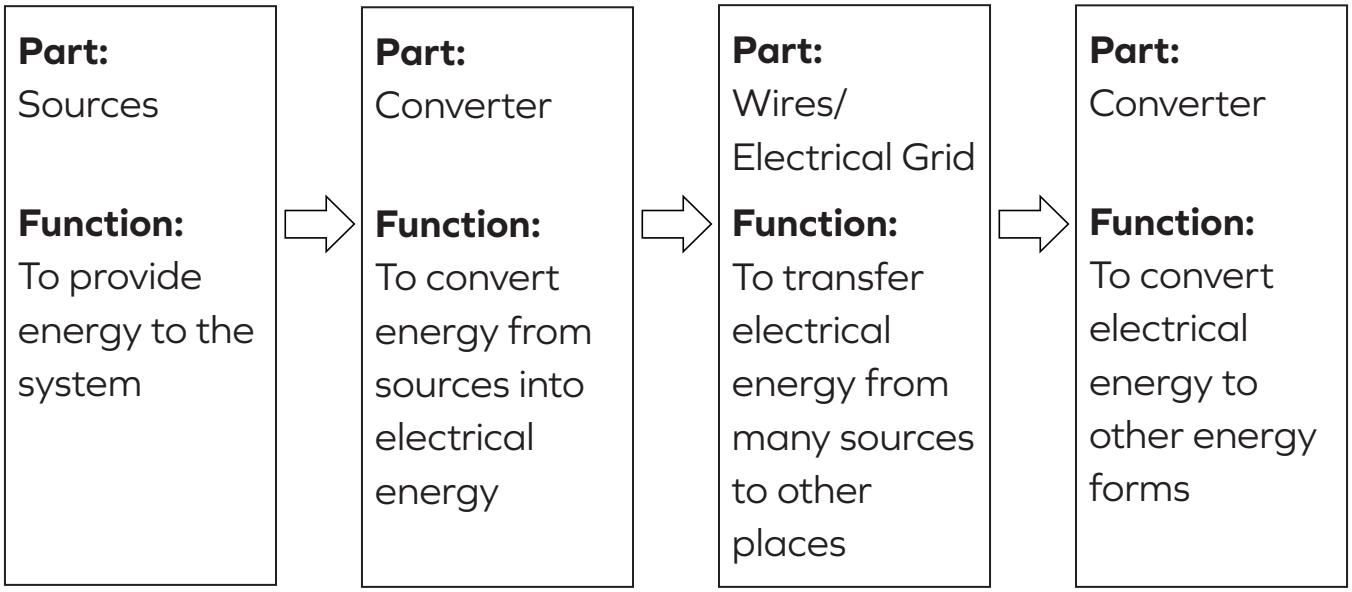
Parts of the System That Failed: *Blackout!*

1. On the line below, record the title of the article you read in *Blackout!*
2. Based on that article, which part or parts of the system failed? Circle that part or parts in the Electrical System below.
3. Explain your response in the space provided below.

Article Headline:

_____

The Electrical System



What evidence did you see or read about in the article that makes you think this?

_____

_____

_____

_____

Name: _____ Date: _____

Synthesizing Ideas About System Failure

1. Read the question below. Talk about it with your group.
2. Record ideas from *Blackout!* and from other sources in the boxes below. If you use an idea from *Blackout!,* write the page number where you found that information.
3. Then, connect the ideas together to answer the question. Write your new understanding in the box below the arrow.

Question: How might a system fail?

Idea: Page:
Idea: Page:
Idea: Page:
Idea: Page:

New understanding:

Name: _____ Date: _____

Reviewing Evidence

1. Carefully examine each piece of evidence to try to find another possible cause of the blackouts in Ergstown.
2. Record what you observe about each piece of evidence in the "What I observe" column.
3. Synthesize what you observe with what you read in *Blackout!* in order to think about what the evidence means for Ergstown. Write your ideas about this in the third column.

Source of evidence	**What I observe**	**Why might this evidence be important?**
Ergstown Weather Report		
Ergstown Blackout Map		
Ergstown Regional Map		

Name: _____ Date: _____

Daily Written Reflection

What do you now know about the electrical system?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Roundtable Discussion

1. With your group, assign Discussion Leader numbers from 1 to 4.
2. Discussion Leader 1 will ask the first discussion question and lead the group's discussion. The Discussion Leader may ask any of the Follow-Up Questions to keep the discussion going.
3. Take turns asking questions until all four group members have had a turn leading the discussion.
4. Be ready to share your group's thinking with the class.

Discussion Questions:

Discussion Leader 1: What does the Ergstown Weather Report tell us about what might have caused the blackouts?

Discussion Leader 2: What does the Ergstown Blackout Map tell us about what might have caused the blackouts?

Discussion Leader 3: What does the Ergstown Regional Map tell us about what might have caused the blackouts?

Discussion Leader 4: What do you think caused the blackouts?

Follow-up Questions:

- What do you think?
- Why do you think so?
- Does anyone have a different idea?
- Do you agree or disagree? Why?

Name: _____ Date: _____

Explaining Ergstown's Blackout

1. Read the question below.
2. Explain what caused the blackout. Make sure to describe why this caused Ergstown's electrical system to fail.

Question: What caused the blackout in Ergstown?

Name: _____ Date: _____

Considering Solutions for Reducing Blackouts

1. Consider each possible solution in the Grid Improvements column below.
2. Review the evidence that you have.
3. In the right-hand column, record what is good and what is not so good about each solution.

Sources of evidence:

Considering Solutions chart (notebook pages 78–79)

System Failure investigation

Evidence from Ergstown

It's All Energy

Blackout!

Name: _____ Date: _____

Considering Solutions for Reducing Blackouts (continued)

Grid improvements	Additional information	Cost	What is good and not so good about this solution?
Add backup wires	Adding wires means that if one wire breaks, there is another wire left working.	$$$	Good: Not so good:
Strengthen grid connections	Strengthening connections will help wires stay connected during storms.	$$	Good: Not so good:

Name: _____ Date: _____

Considering Solutions for Reducing Blackouts (continued)

Grid improvements	Additional information	Cost	What is good and not so good about this solution?
Move grid underground	Moving wires underground will protect the wires from storms	$$$$	Good: Not so good:

Name: _____ Date: _____

You can use this page to record notes or create drawings.

Name: _____ Date: _____

Daily Written Reflection

The electrical grid is one part of the larger electrical system. What happens to the electrical system if the electrical grid is not functioning?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Gathering Evidence of Efficiency in the Sim

1. In the *Energy Conversions* Sim, set up tests to compare how efficient these different energy solutions are: sun (solar energy), wind (wind power), and fuel (fossil fuel power plant).
2. Record your observations and results below.

Test A: Build two similar systems that both have an LED output device. Use a **different energy source** and **source converter** for each system.

System 1: What parts does it include?

Energy transferred in: _____

Energy transferred out: _____

System 2: What parts does it include?

Energy transferred in: _____

Energy transferred out: _____

Compare the difference in light energy output between System 1 and System 2. Which system is more energy efficient? Record your evidence.

_____

_____

_____

Name: _____ Date: _____

Gathering Evidence of Efficiency in the Sim (continued)

Test B: Build two similar systems that have light as the output energy form. Use two **different electrical devices** to produce light.

System 3: What parts does it include?

Energy transferred in: _____

Energy transferred out: _____

System 4: What parts does it include?

Energy transferred in: _____

Energy transferred out: _____

Compare the difference in light energy output between System 3 and System 4. Which system is more energy efficient? Record your evidence.

_____

_____

_____

Name: _____ Date: _____

Daily Written Reflection

What have you learned about energy that might help you in your daily life?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

Name: _____ Date: _____

Preparing for the Town Hall Meeting

1. Refer to your completed Possible Solutions for Improving Ergstown Electrical System chart.
2. Read the question below.
3. Pick two solutions that you want to propose in response to the question.
4. For each solution, write what part of the system should be improved and how. Next, explain how the solution meets the criteria and provide evidence for that. Then, explain one way the solution does not meet the criteria very well.

Question: What are the best solutions for improving Ergstown's electrical system and why?

Solution 1: I think we should improve the _____

by _____

_____

This solution meets the criteria because:

_____

_____

My evidence is:

_____

_____

_____

_____

Name: _____ Date: _____

Preparing for the Town Hall Meeting (continued)

This is one way the solution does not meet the criteria very well:

_____

_____

Solution 2: I think we should improve the _____

by _____.

_____

This solution meets the criteria because:

_____

_____

My evidence is:

_____

_____

_____

_____

This is one way the solution does not meet the criteria very well:

_____

_____

Name: _____ Date: _____

Preparing for the Town Hall Meeting (continued)

Scientific Language for the Town Hall Meeting

The best solution for Ergstown is _____.

This solution meets the criteria of _____ because _____.

The evidence for this is _____.

The limitation of this solution is _____.

Follow-up Questions in the Town Hall Meeting

Which solutions are not very expensive?

Which solutions are safe for the environment?

Which solutions save energy or convert more energy?

Which solutions are the most reliable?

Which solutions will not bother the people of Ergstown?

Name: _____ Date: _____

Synthesizing Ideas About the Electrical System

1. Read the Unit Question.
2. Write your ideas about the question, using all you have learned about energy.
3. Then, connect the ideas together to answer the Unit Question. Write your new understanding in the box below the arrow.

Unit Question: How does the electrical system work?

What I learned about systems:
What I learned about energy sources:
What I learned about converters:
What I learned about the electrical grid:

New understanding:

Name: _____ Date: _____

Chapter 4: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists and engineers investigate in order to figure things out. Am I getting closer to figuring out a design that improves Ergstown's electrical system?

I understand why a device might not work. _____ Yes _____ Not yet

I understand what happens when a device is plugged in. _____ Yes _____ Not yet

I understand where energy in a system comes from. _____ Yes _____ Not yet

I understand what happens when there is not enough energy in a system. _____ Yes _____ Not yet

I understand what happens when there are too many devices in a system. _____ Yes _____ Not yet

I understand why the lights went out in Ergstown. _____ Yes _____ Not yet

I understand that science affects everyday life. _____ Yes _____ Not yet

What about the blackout in Ergstown or energy are you still wondering?

_____

_____

_____

_____

Glossary

argument: the use of evidence to say why one idea is the best
argumento: el uso de evidencia para decir por qué una idea es la mejor

claim: a proposed answer to a question
afirmación: una respuesta propuesta para una pregunta

convert: to change from one form to another
convertir: cambiar de una forma a otra

converter: something that changes one form of energy to another
convertidor: algo que cambia una forma de energía a otra

criteria: the things that engineers think about and test in order to know how well something solves a problem
criterios: las cosas que los ingenieros piensan y testean con el fin de saber cuán bien algo soluciona un problema

design: to try to make something new that solves a problem
diseñar: intentar crear algo nuevo que resuelva un problema

electrical device: a machine that converts electrical energy to another form of energy
aparato eléctrico: una máquina que convierte la energía eléctrica en otra forma de energía

electrical energy: the form of energy that is transferred through wires
energía eléctrica: la forma de energía que se transfiere a través de cables

electrical grid: wires that transfer electrical energy from many sources to many other places
red eléctrica: cables que transfieren energía eléctrica proveniente de muchas fuentes hacia muchos otros lugares

Glossary (continued)

energy: the ability to make things move or change
energía: la capacidad de hacer que las cosas se muevan o cambien

engineer: a person who uses science knowledge to design something in order to solve a problem
ingeniero/a: una persona que usa conocimientos científicos para diseñar algo que resuelva un problema

evidence: information that supports an answer to a question
evidencia: información que respalda una respuesta a una pregunta

form (of energy): type or kind (of energy)
forma (de energía): tipo o clase (de energía)

function: what something can do
función: lo que algo puede hacer

source: the place where something comes from
fuente: el lugar desde donde viene algo

synthesize: to put together multiple pieces of information in order to understand something
sintetizar: juntar varias piezas de información con el fin de entender algo

system: a group of parts that work together
sistema: un grupo de partes que trabajan juntas

transfer: to move something from one place to another
transferir: mover algo de un lugar a otro

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Your Investigation Notebook

Scientists use notebooks to keep track of their investigations. They record things they learn from other scientists. Sometimes they draw or make diagrams. They record ideas and information they want to remember.

Your Investigation Notebook is a place for you to keep track of:

- investigations you do in class.
- what you learn from reading science books.
- your questions, predictions, and observations.
- your explanations and the evidence you find to support those explanations.
- your ideas!

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