Lesson 3: Providing Light for Your Plants

Lesson Snapshot

Overview

Big Idea: Electricity is a form of energy that can provide light.
Teacher's Note: Big ideas should be made explicit to students by writing them on the board and/or reading them aloud.

Purpose of Lesson: This lesson requires students to create and illustrate a diagram of an electrical circuit that will provide light to their lunar plant growth chamber.

Lesson Duration: Two hours.

Activity Highlights

Engagement: The teacher leads a discussion about lights/electricity with students as they enter the room with the lights off. As the teacher turns a flashlight on and off, students answer questions. The students answer a question as the teacher turns a radio/television on and off. The teacher unplugs an object and students discuss why it is not able to work.

Exploration: Students observe objects that complete an electrical circuit. As they observe these objects, they write a response and definition on a worksheet. The teacher leads a discussion about each object. The correct spelling and definition are written on a chart. As a whole group, students connect parts to create an electrical circuit. The teacher guides students through a booklet about electricity. Students read, discuss and illustrate.

Explanation: Students discuss whether their circuit and switch works properly and why a switch is important. Students discuss how lights help plants, why an electrical circuit is needed in a lunar plant growth chamber and what source of electricity astronauts would take to the moon.

Extension: Students draw a sketch of an electrical circuit. Students build an electrical circuit.

Evaluation: Rubrics guide and assess:

- Student diagrams of electrical circuit
- Assessment
- Student electrical circuits

Lesson 3: Overview

Lesson Duration

- Two hours.

Standards/Benchmarks

Technology: Standards for Technological Literacy (*STL*) *(ITEA, 2000/2002)*

- Students will develop an understanding of the core concepts of technology. (ITEA/*STL* 2)
  - Systems have parts or components that work together to accomplish a goal. (ITEA/*STL* 2B)
- Students will develop an understanding of engineering design. (ITEA/*STL* 9)
  - Expressing ideas to others verbally and through sketches and models is an important part of the design process. (ITEA/*STL* 9B)
- Students will develop the abilities to use and maintain technological products and systems. (ITEA/*STL* 12)
  - Use hand tools correctly and safely and be able to name them correctly. (ITEA/*STL* 12B)
- Students will develop an understanding of and be able to select and use energy and power technologies. (ITEA/*STL* 16)
  - Energy comes in many forms. (ITEA/*STL* 16A)

Science: Benchmarks for Science Literacy *(AAAS, 1993)*

- Tools are used to do things better or more easily and to do some things that could not otherwise be done at all. In technology, tools are used to observe, measure and make things. (AAAS 3A)
- Several steps are usually involved in making things. (AAAS 8B)
- Tools are used to help make things, and some things cannot be made at all without tools. Each kind of tool has a special purpose. (AAAS 8B)
- Most things are made of parts. (AAAS 11A)
- Something may not work if some of its parts are missing. (AAAS 11A)
- When parts are put together, they can do things that they couldn't do by themselves. (AAAS 11A)
- Make something out of paper, cardboard, wood, plastic, metal or existing objects that can actually be used to perform a task. (AAAS 12C)
- Use hammers, screwdrivers, clamps, rulers, scissors and hand lenses and operate ordinary audio equipment. (AAAS 12C)
- Draw pictures that correctly portray at least some features of the thing being described. (AAAS 12D)

Science: National Science Education Standards *(NRC, 1996)*

- Students should develop an understanding of light, heat, electricity and magnetism. (NSES – Physical Science – Content Standard B)
  - Electricity in circuits can produce light, heat, sound and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass. (NSES)

Learning Objectives

Students will learn to:

1. Identify and describe two sources of electricity (electrical outlets and batteries).
2. Identify and describe components that are needed to create an electrical circuit.
3. Express their ideas by sketching a diagram of an electrical circuit.

Student Assessment Tools and/or Methods

1. Rubric for Diagram of Electrical Circuit

Category	Below Target – 0	At Target – 1	Above Target – 2
Diagram	Few pictures are accurately drawn, with few or no details.	Most pictures are accurately drawn, with some details.	All pictures are accurately drawn, with many details.
Sequence	Most parts are connected out of sequence.	Most parts are connected in the correct sequence.	All parts are connected in the correct order.
Labels	Few labels are correct, with few or no details.	Most labels are correct, with some details.	All labels are correct, with many details.
Neatness	Diagram is not neat. A small amount of text is neat. There are many visible stray marks and/or smears.	Diagram is neat. Most text is neat. There are few visible stray marks and/or smears.	Diagram is neat. All text is neat. There are no visible stray marks and/or smears.
Spelling	Many words are misspelled.	Most words are spelled correctly.	All words are spelled correctly.
Teacher Comment			

2. Rubric for Assessment

Requirements	Requirement Achieved
Question 1	3
Question 2	4
Question 3	4
Question 4	12
Question 5	3
Score:	24

Above Target	21-24
On Target	17-20
Below target	0-16

3. Rubric for Assessment Question 5

Category	Below Target – 0	At Target – 1	Above Target – 2
Application	Student did not apply what he or she learned about electricity to answer the question.	Student mostly applied what he or she learned about electricity to partially answer the question.	Student applied what he or she learned about electricity to correctly answer the question.
Organization	The explanation is incomplete, unorganized and not logical.	The explanation is somewhat complete, well organized and/or logical.	The explanation is complete, well organized and logical.
Vocabulary	No science vocabulary used to explain the answer.	Some science vocabulary to used explain the answer.	A good deal of science vocabulary used to clearly explain the answer.
Conventions (Capitalization, Usage, Punctuation, Spelling)	Many errors interfere with the meaning and confuse the reader.	Few errors, some of which interfere with the meaning and confuse the reader.	No errors interfere with the meaning or confuse the reader.
Teacher Comment			

4. Rubric for Electrical Circuit

Category	Below Target – 0	At Target – 1	Above Target – 2
Parts	Some parts are missing. Parts are not securely attached.	Most parts are included. Most parts are attached securely.	All parts are included. Everything is securely fastened.
System	Circuit does not work; bulb does not light	System is working, but occasionally the light goes out.	System is working properly.
Neatness	Few wires fit neatly within the system. Lots of glue is showing. Tape is not wound neatly and tightly.	Most wires fit neatly within the system. Some glue is showing. Most tape is wound neatly and tightly.	All wires fit neatly within the system. No glue is showing. All tape is wound neatly and tightly.
Teacher Comment			

Resource Materials

Print Materials

1. Mayes, S. (1989). *Where does electricity come from?* London: Usborne.
2. Olien, B. (2003). *Electricity*. Mankato, Minn.: Bridgestone Books.
3. Royston, A. (2002). *My world of science, using electricity.* Chicago: Heinemann Library.
4. Tocci, S. (2001). *A true book: Experiments with electricity*. New York: Children's Press.
5. Trumbauer, L. (2004). *What is electricity?* New York: Children's Press

Audiovisual Materials

1. Hoard, D. C. (Producer), & Gluck, D. H. (Director). (2000). *All about the uses of energy* (Video). Wynnewood, PA: Schlessinger Media.
2. Martin, K. L. (Producer), & Jacobs, L. (Director). (1997). *The magic school bus getting energized* (Video). New York: Kid Vision.
3. Palacio, O. (Producer). (2000). *All about electricity* (Video). Wynneswood, PA: Schlessinger Media.
4. Schlessinger A., Mitchell, T. & Gluck, D. (Executive Producers). (2000). *All about the conservation of energy* (Video). Wynnewood, PA: Schlessinger Media.
5. Schlessinger A., Mitchell, Tr. & Gluck, D. (Executive Producers). (2000). *What is energy?* (Video). Wynnewood, PA: Schlessinger Media.

Internet Sites

1. Beaty, W. J. (1996). *What is electricity?* Retrieved April 14, 2007 from http://amasci.com/miscon/whatis.html
2. Nick and S. (March 31, 1999). *The shocking truth about electricity*. Retrieved April 14, 2007 from http://library.thinkquest.org/6064/main.html
3. *Electricity and magnetism*. (n.d.). Retrieved April 14, 2007 from http://www.galaxy.net/~k12/electric/
4. Energy Information Administration. (n.d.). *Electricity basics 101*. Retrieved April 14, 2007 from http://www.eia.doe.gov/basics/electricity_basics.html

Required Knowledge and Skills

Students should be able to identify and describe how we use electricity in our daily lives (homes, schools, car).

Lesson 3: 5-E Lesson Plan

Engagement

1. The teacher has the lights turned off when students enter the room.

   The teacher asks the following questions:
   - How do we turn the lights on in our room?
   - Why is there a switch?
   - What is electricity?
   - Where does electricity come from?
   - Why is light important?

2. The teacher turns a flashlight on and off.

   The teacher asks the following questions:
   - What do you see when this switch is flipped up and down?
   - What allows the lightbulb to light up?
   - What is the source of electricity? (battery)

3. The teacher turns a radio/television on and off.

   The teacher asks the following question:
   - What allows this piece of equipment to turn on and off?

4. The teacher unplugs the radio/television.

   The teacher asks the following questions:
   - Why isn't it working?
   - What is the source of electricity? (electrical outlet)

Exploration

1. The teacher shows students a lightblub, light socket, wire, battery, battery holder and wire strippers. As they see each object, the students illustrate, label and describe what each object does on the worksheet Parts of an Electrical Circuit (***Providing Light for Your Plants 1***).
2. The teacher holds up one object at a time again and has students share their responses. As students respond, the teacher writes an accurate spelling of each word and definition on a chart.
   - A lightblub provides light.
   - A light socket is a device that holds a lightblub
   - A battery stores electricity.
   - A battery holder is a device that holds batteries.
   - A wire is a metal piece that allows electricity to flow through it.
   - A wire stripper is a device that strips the plastic covering off of a wire so that metal wire can be seen.

3. The teacher asks students the following questions:
   - If we put all these parts together, what do you think it will create?
   - What would we need to do to get the lightblub to light up?
   - What form of energy do you think we are using?

4. The teacher gathers students in a large circle on the floor. The teacher places a light bulb, light socket, batteries, battery holders and wires that have been stripped of a ½ inch of plastic at both ends in the middle of the circle. As a whole group, the students construct the circuit under the teacher's direction. It is important for the teacher to stress that no wires in the circuit should ever be allowed to touch. Students should also be told that the ends of a battery should never be wired together. It is suggested that the batteries be placed in the holder last. (If the students are not using the battery holder, the teacher should ensure that students do not allow the two wires attached to the battery to touch.) The teacher can refer to the ***Photographic Overview of Unit*** for instructions on how to complete an electrical circuit.

   The teacher asks students the following questions:
   - Why did you decide to connect those two parts?
   - Why do you think this circuit works/does not work?
   - What would happen if you didn't connect the wire to the light socket?
   - What happens when you only attach one wire to the battery?
   - What happens when metal pieces are not touching?

5. The teacher introduces and defines the term "circuit."

   - A circuit is the path that allows electricity to flow (the energy source [battery] connects to a wire, the wire connects to a light socket, the light socket connects to another wire, that wire connects back to the other side of the energy source).
   - The teacher explains that an electrical circuit must be a closed loop so an electrical current can pass. There cannot be any openings. All parts must be joined.
   - The teacher shows what happens when a circuit is not closed.

6. The teacher asks students the following question:
   - What do you think we would need if we want to turn the light on and off?

7. The teacher introduces and defines the term "switch".
   - A switch is an object that allows electricity to turn on and off within a circuit.

8. The teacher shows students a piece of wood, two push pins and a paper clip.

   The teacher asks students the following question:
   - How could we use these parts to create a switch?

9. The teacher places the wood, push pins and paper clip in the center of the circle. Under the direction of the teacher, various students add these new components to the circuit they just completed as a group.

10. The teacher should ask students the following questions:
    - Why do objects need switches?
    - Why is it important to turn lights on and off?

11. The teacher provides each student with the booklet, Electricity (***Providing Light for Your Plants 2***). The students read page one, discuss the information on the page and draw a picture. The teacher guides the students through each page in the same manner, allowing time for the students to cut out and staple the booklets.

The teacher asks students the following questions:

- Which natural resources are used to produce electricity?
- What are two sources of electricity?
- What objects use electricity to produce heat?
- What objects use electricity to produce sound?
- What objects use electricity to produce light?
- Why is electricity important to us?
- What would happen if we didn't have electricity?

12. Students explore new terms and concepts by reading selected books or listening to the teacher read.
13. Students explore new terms and concepts by viewing selected videos.
14. Students explore new terms and concepts by viewing selected Internet sites.

Explanation

1. Students explain verbally why they think the system works/does not work.
2. Students explain verbally how the switch was set up and why they think it works/does not work.
3. Students explain verbally why a switch will be important in their design.
4. Students verbally answer the following questions:
   - Do lights help plants to grow?
   - Why do you think an electrical circuit is needed in a lunar plant growth chamber?
   - What source of electricity do you think astronauts would be able to take to the moon easily?

Extension

1. Students sketch and label a diagram of an electrical circuit (***Worksheet 2 in the Engineering Portfolio and Journal***).
2. Students build an electrical circuit to light a bulb for use in a lunar plant chamber.

Evaluation

Rubrics guide and assess:

1. Student diagrams of an electrical circuit.
2. Student answers to questions about electricity. Assessment (***Providing Light for Your Plants 3***)
3. Students' electrical circuits.

Enrichment

1. Students can research electricity on the Internet.
2. Students can create a safety brochure about electricity.
3. Students could write a letter to an electrical company asking for information on electricity.

Lesson 3: Lesson Preparation

Teacher Planning

1. Make copies of the booklet, Electricity (***Providing Light for Your Plants 2***).
   Answer key for the booklet, Electricity
   1. Page 7 – flashlight, lamp, television, computer, etc.
   2. Page 8 – oven, dryer, blow dryer, curling iron, etc.
   3. Page 9 – television, radio, computer, telephone, video games, alarm clock, etc.
   4. Page 10 – the light will provide warmth to the seeds and light to the plants
   5. Page 12 – answers will vary

2. Make copies of Engineering Worksheet 2 (***Engineering Portfolio and Journal***).

3. Make copies of Assessment (***Providing Light for Your Plants 3***).
   Answer key for assessment piece
   1. Electricity
   2. Electrical outlet and batteries
   3. Batteries, light socket, lightblub, switch
   4. Please refer to definitions listed in lesson.
   5. No, electricity will not flow through this circuit. Electricity will not flow through the circuit because it is not a complete loop. The student should explain that the battery wire is not attached to the light socket.

4. Make sure you have all the tools/materials available.
5. Provide an area where all students can gather for the group discussion and assembly of the electrical circuit.
6. The battery holder has short wires that may be difficult to strip. The teacher may want to strip these wires before passing them out to students.

Tools/Materials/Equipment

- D-cell batteries (2)
- Battery holders
- Block of wood (2" x 2")
- Chart paper
- Electrical tape
- Flashlight
- Goggles
- Hammer
- Light bulbs
- Light sockets
- Paper
- Paper clips
- Pencils
- Screwdrivers
- Push pins
- Wire
- Wire strippers
- Copies of the booklet, Electricity (***Providing Light for Your Plants 2***).
- Copies of Engineering Worksheet 2 (***Engineering Portfolio and Journal***).
- Copies of the assessment piece (***Providing Light for Your Plants 3***).

Teacher Note: The teacher may choose to use other materials when creating an electrical circuit. A rubber band can be used to hold wires directly to the battery. A circuit can be created with just a light socket, lightblub, wire and a battery if the funds are not available to purchase all the materials above.

Teacher Note: Batteries must be matched to devices. A potential resource for teachers is the book, *Understanding Science Ideas – A Guide for Primary Teachers*. From that book (p. 69):

4.5V battery + 1.5V bulb = blown bulb
1.5V battery + 4.5V bulb = dim bulb
4.5V battery + 3V bulb = light shines normally

Classroom Safety and Conduct

Students are expected to follow normal classroom and school safety rules.

Tool Safety Rules should be posted and reviewed:

1. Students should wear safety goggles at all times.
2. Students should carefully watch what they are doing when using tools.
3. Students should make sure vises, clamps and miter boxes are fastened securely.
4. Students should check to make sure all tools are safe and not use broken tools.

Electrical circuit safety:

1. Students should connect all wires before placing the batteries in place.
2. If students are using a battery holder, they should make sure that the wires do no touch each other when the batteries are in place.
3. If students are not using the battery holder, they should make sure the two wires that are connected to the battery do not touch.
4. Students should make sure that, when connecting wires together, electrical tape is wrapped around them to cover exposed wires.

Parts of an Electrical Circuit

Name _____

Illustrate and label each object your teacher shows you. Write a sentence explaining what you think each one does.

1.

2.

3.

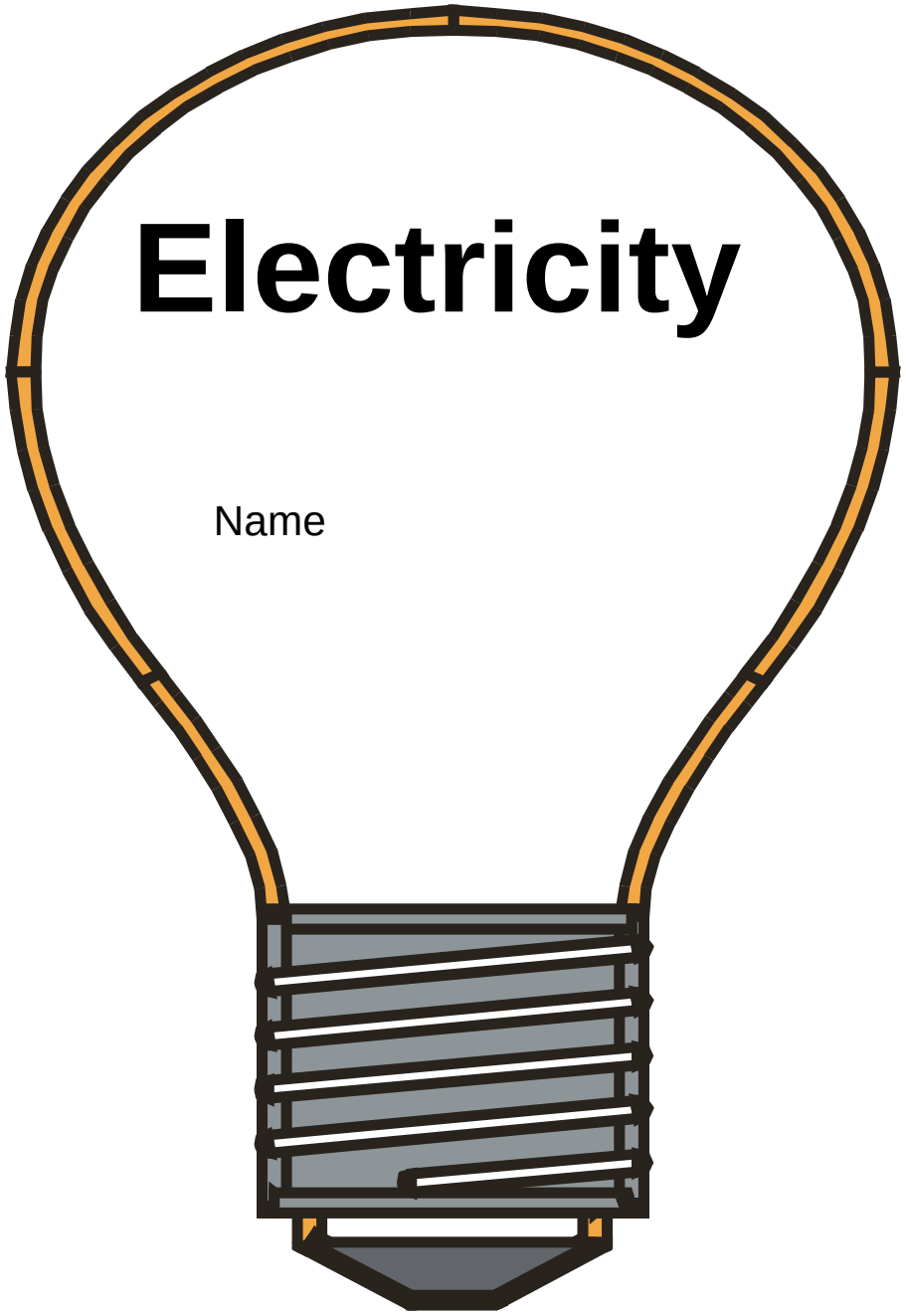
4.

5.

6.

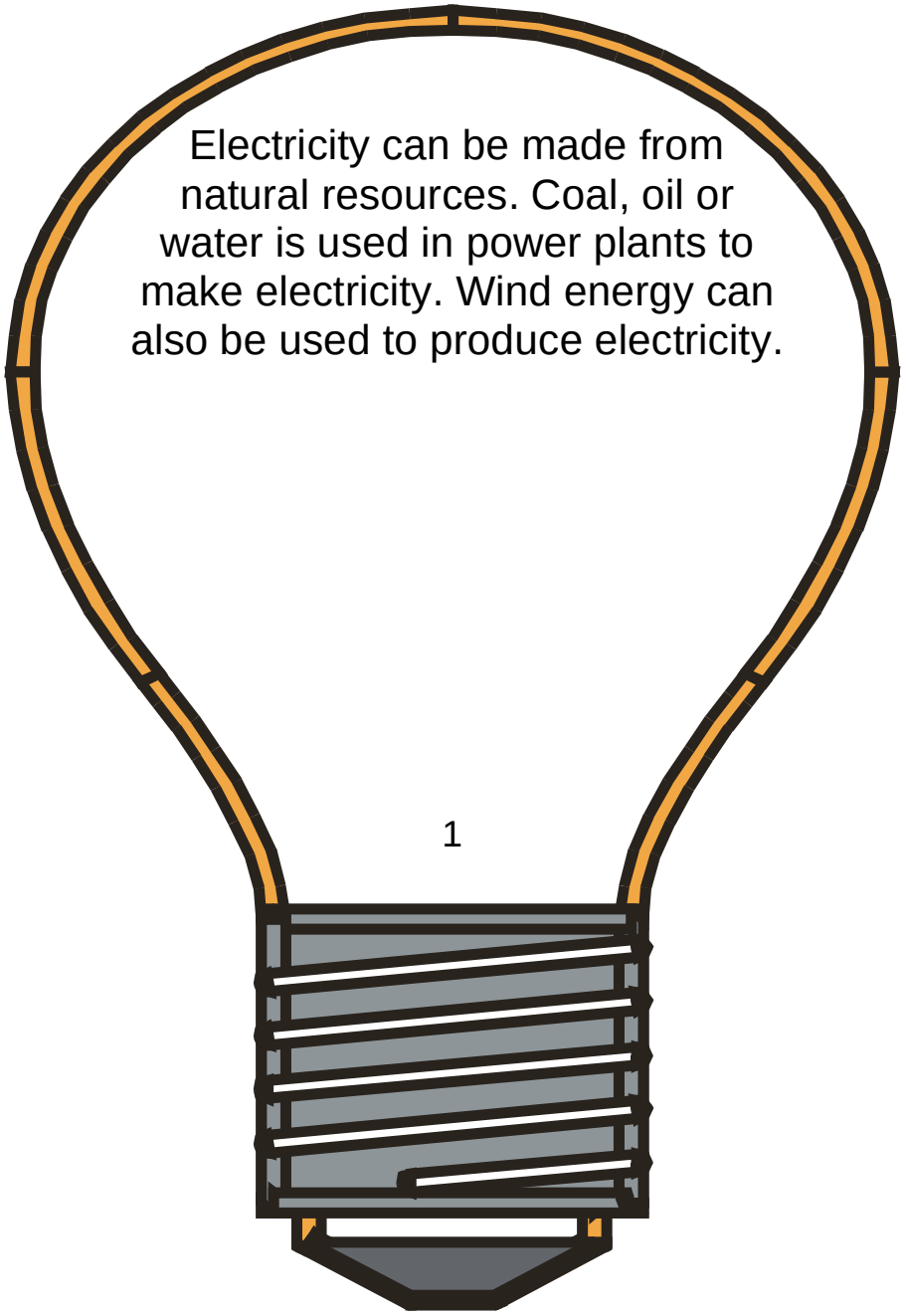
Electricity

Name



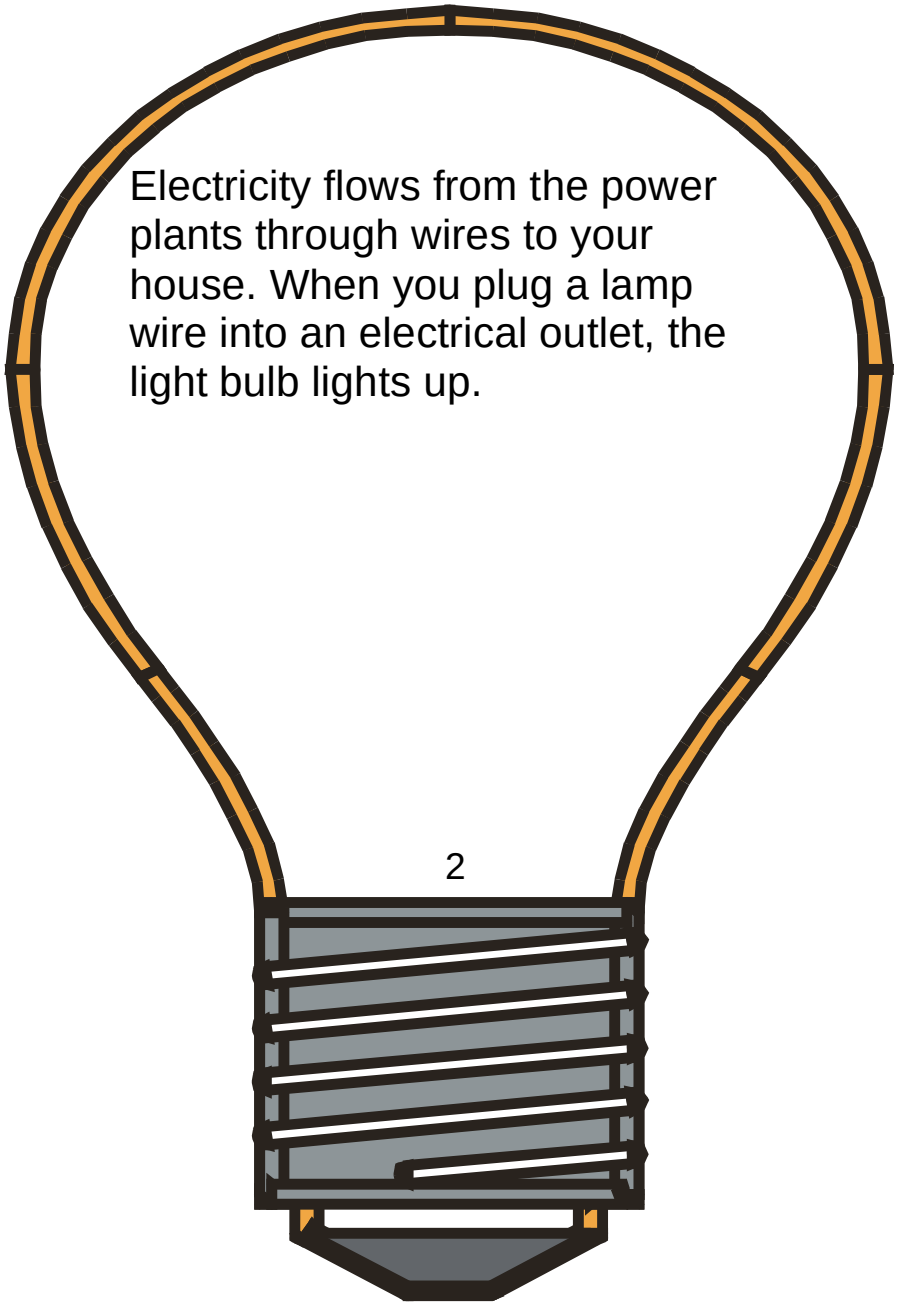
Electricity can be made from natural resources. Coal, oil or water is used in power plants to make electricity. Wind energy can also be used to produce electricity.

1



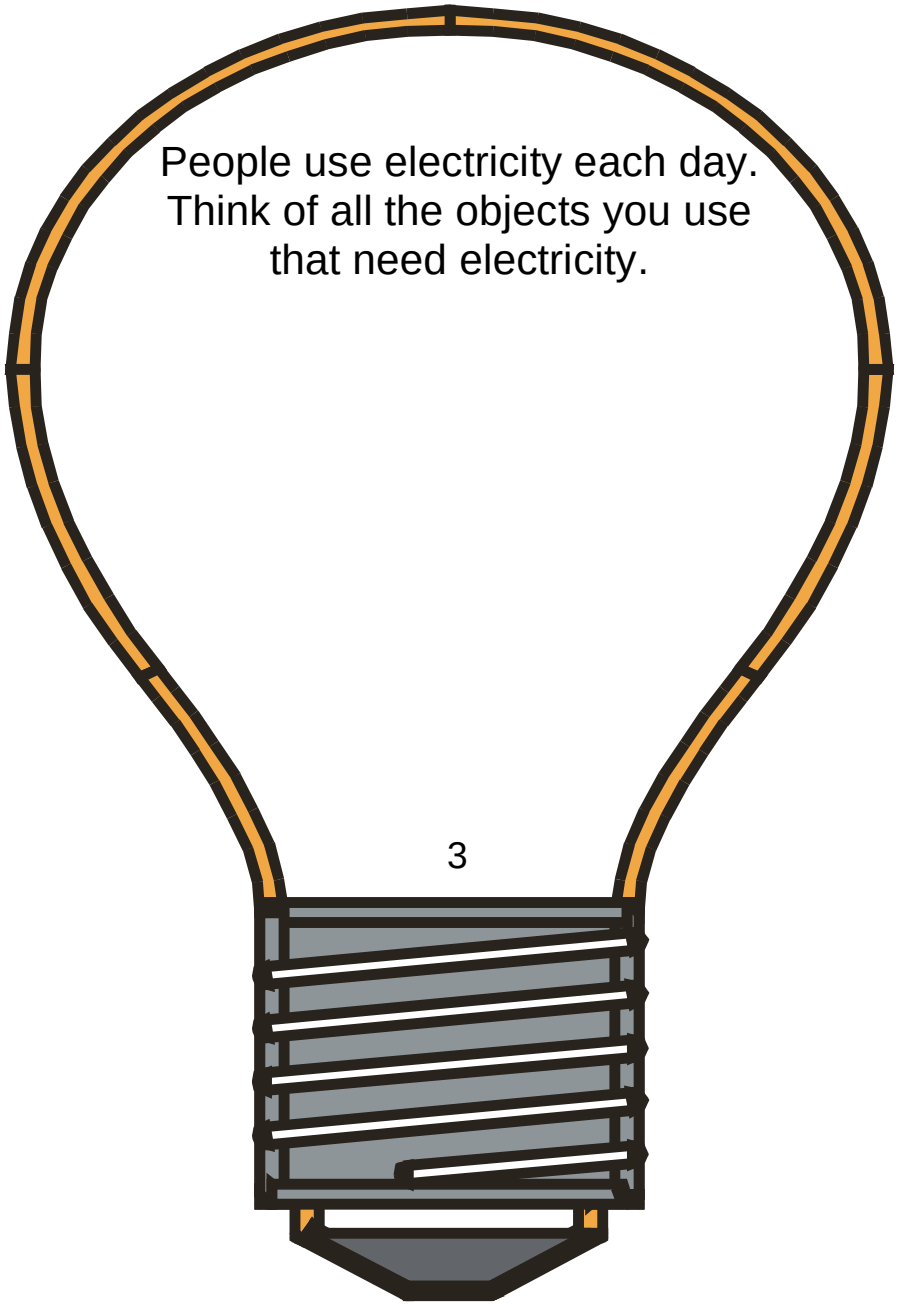
Electricity flows from the power plants through wires to your house. When you plug a lamp wire into an electrical outlet, the light bulb lights up.

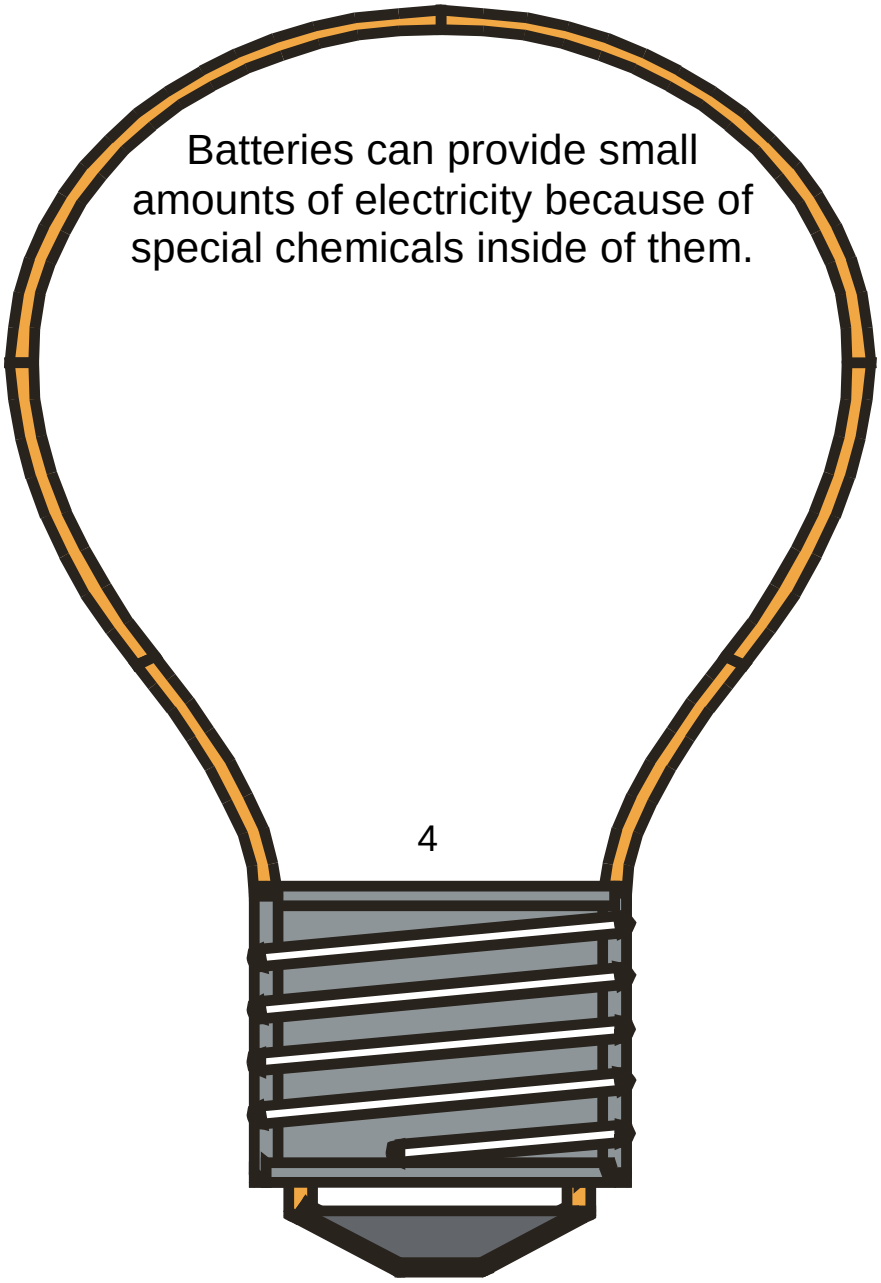
2

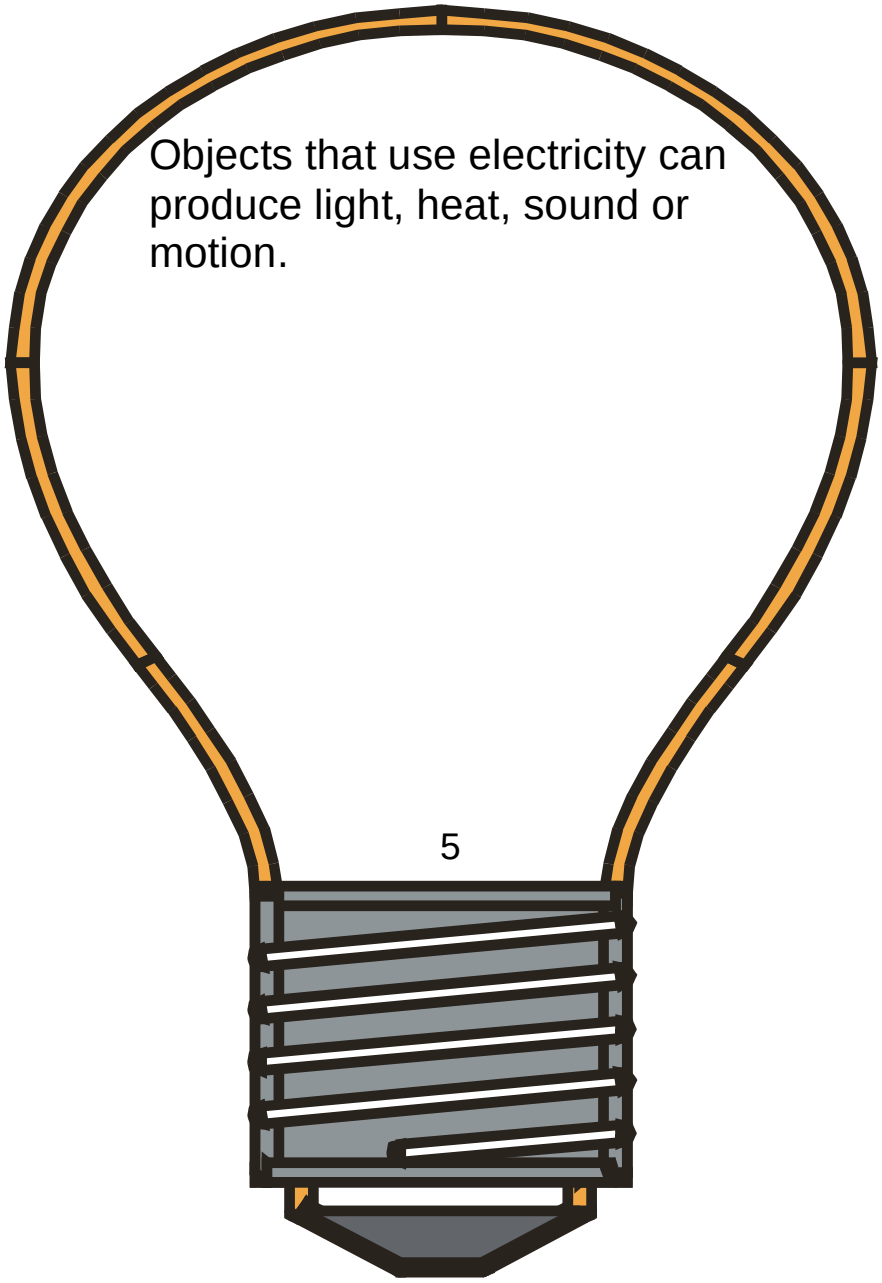


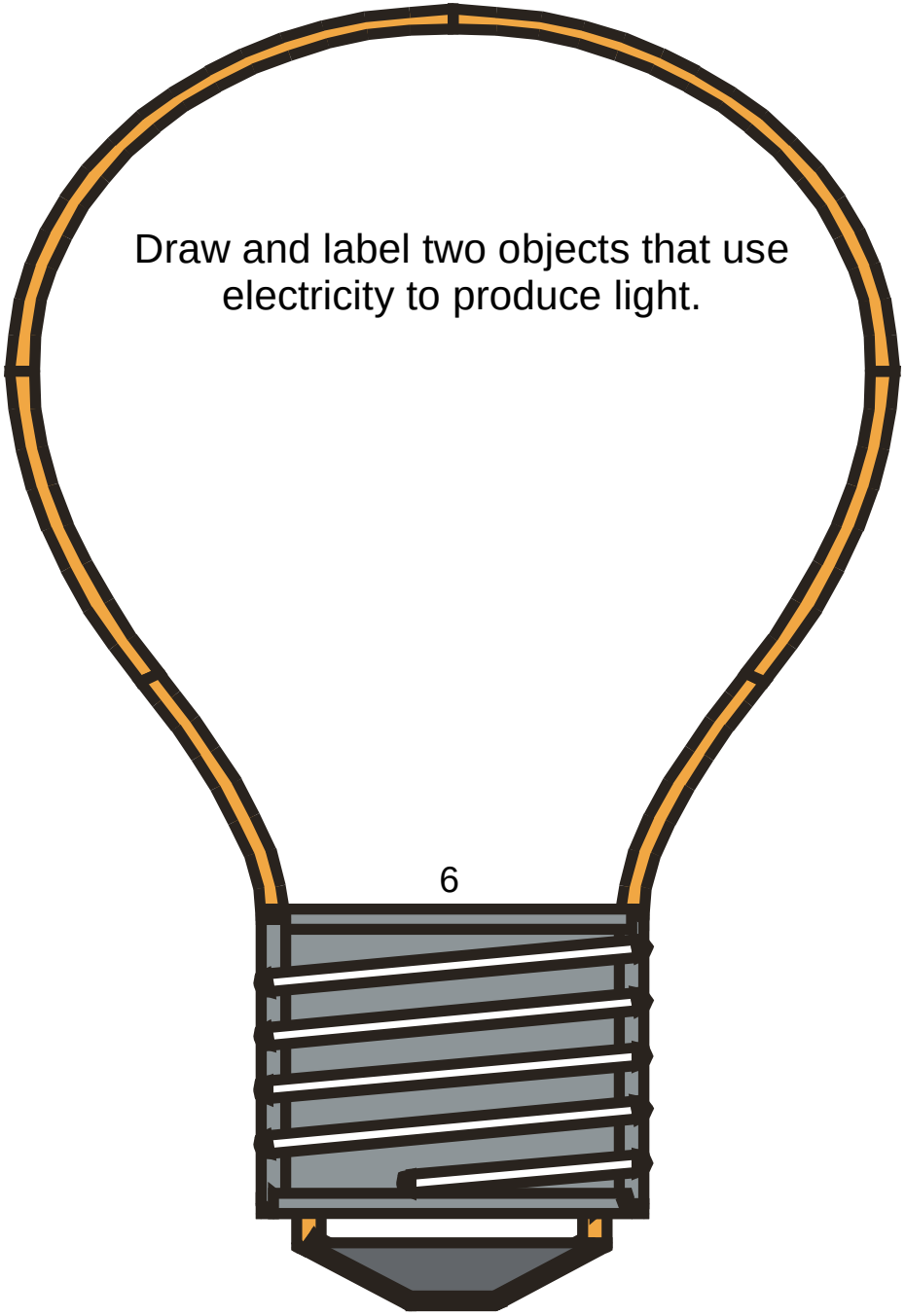
People use electricity each day. Think of all the objects you use that need electricity.

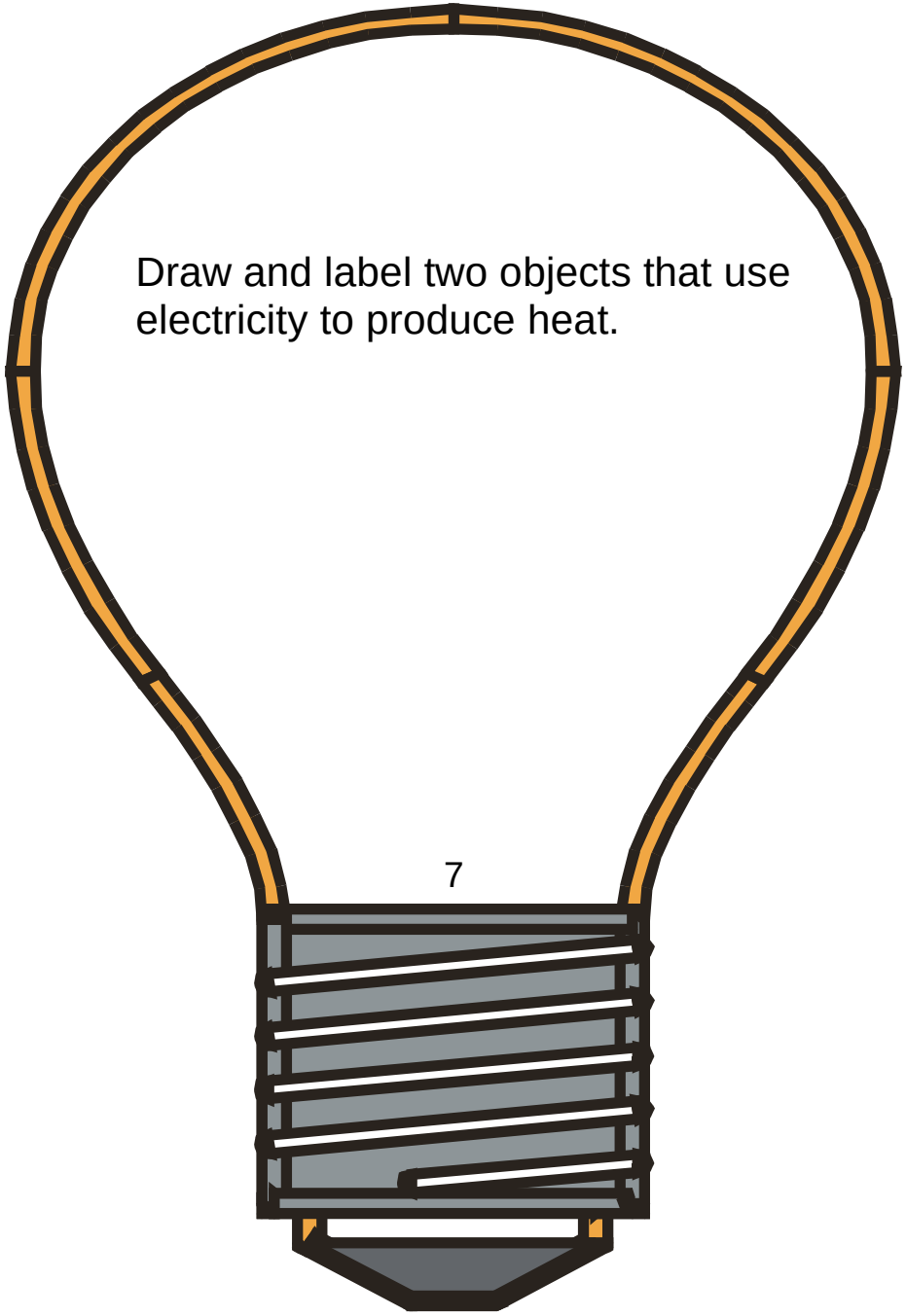
3

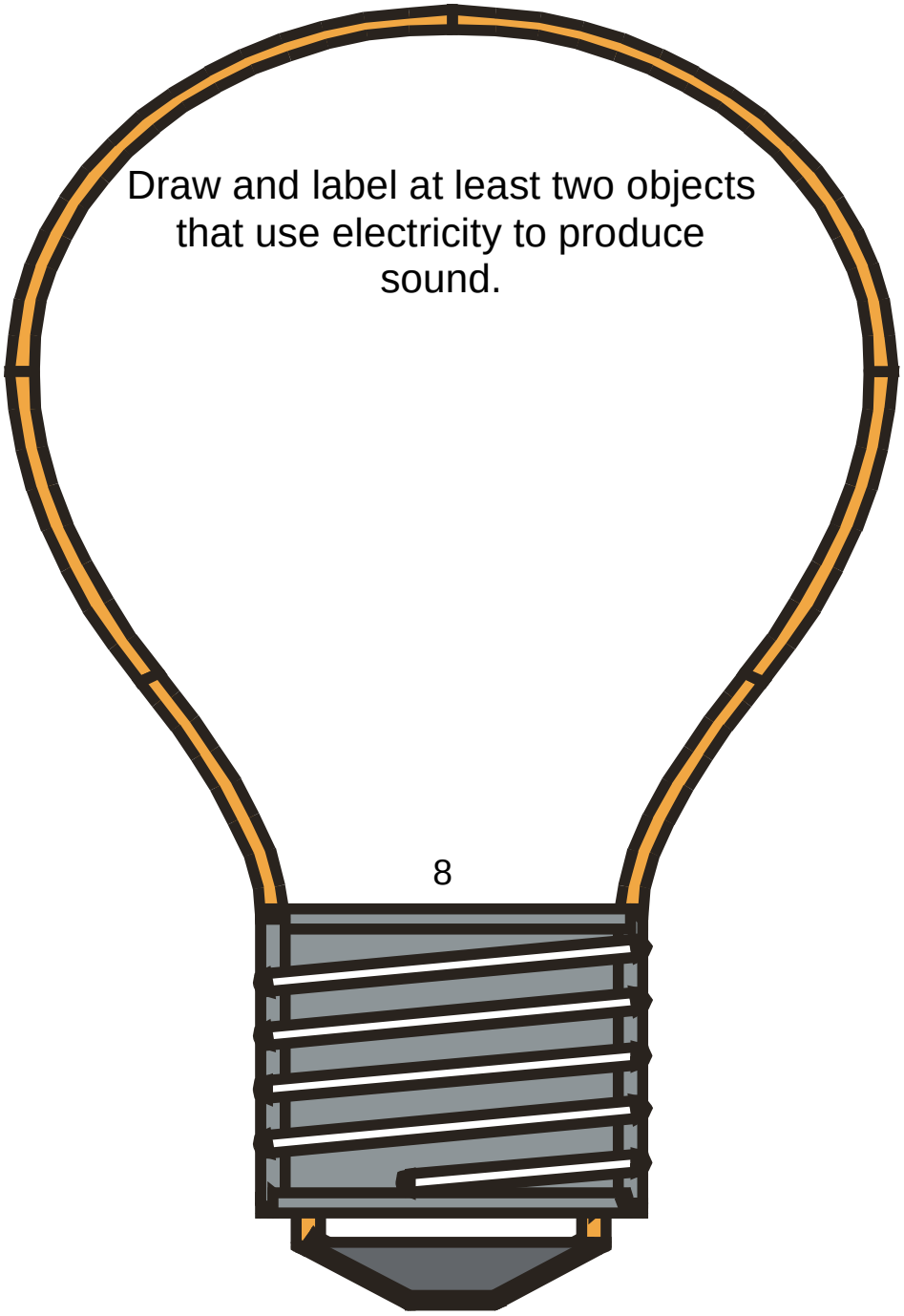


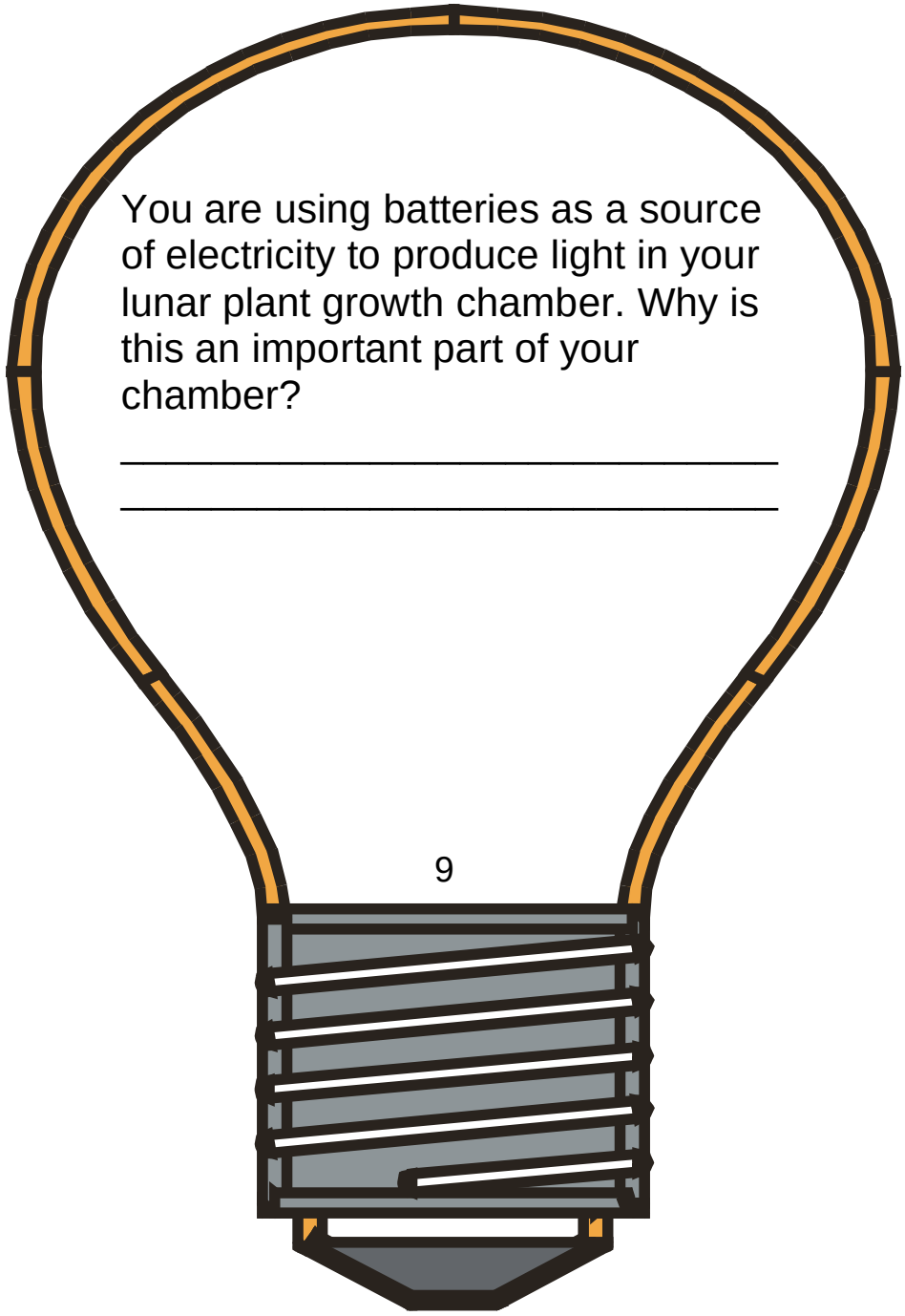

Batteries can provide small amounts of electricity because of special chemicals inside of them.
4

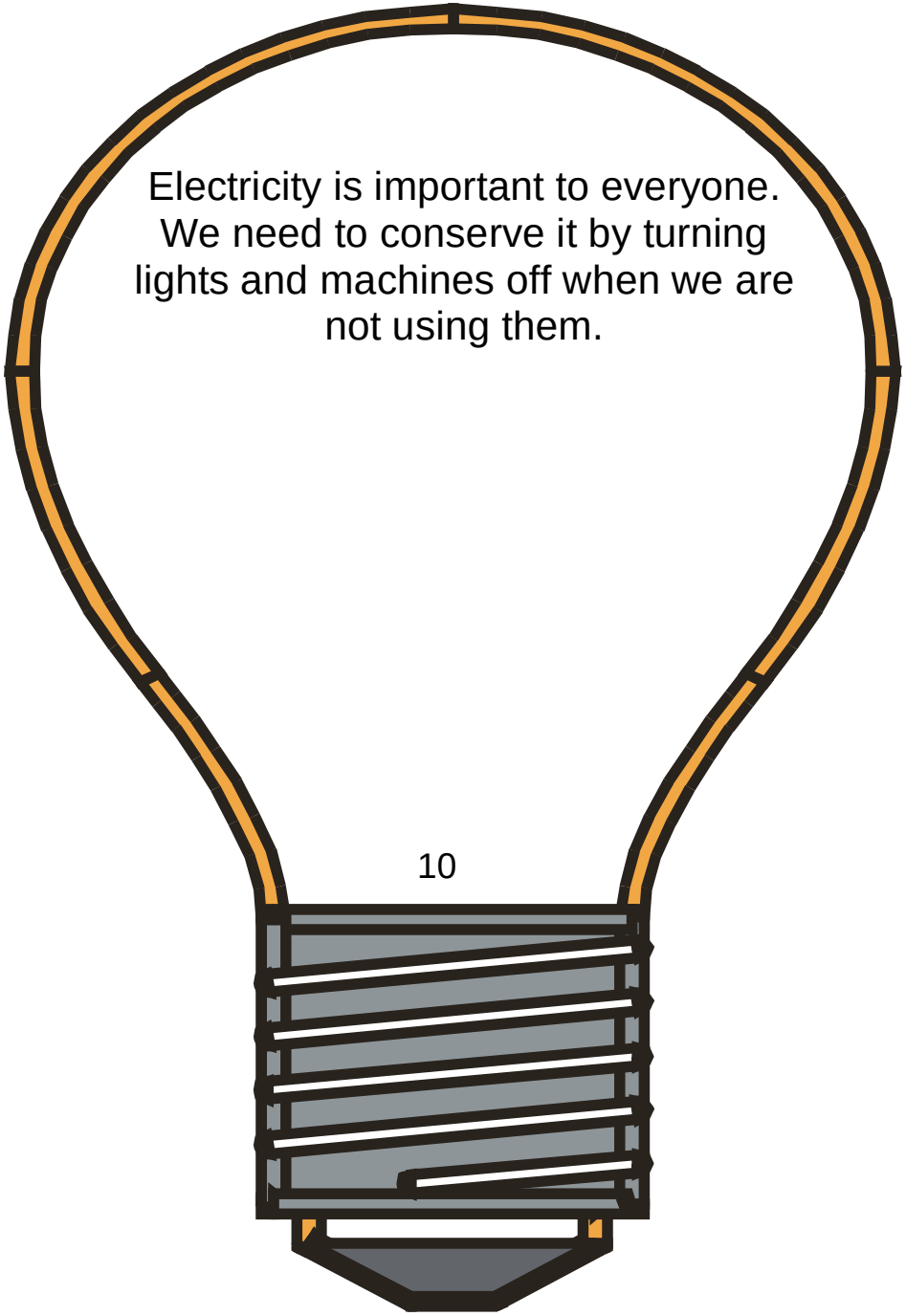

Objects that use electricity can produce light, heat, sound or motion.
5


Draw and label two objects that use electricity to produce light.
6


Draw and label two objects that use electricity to produce heat.
7

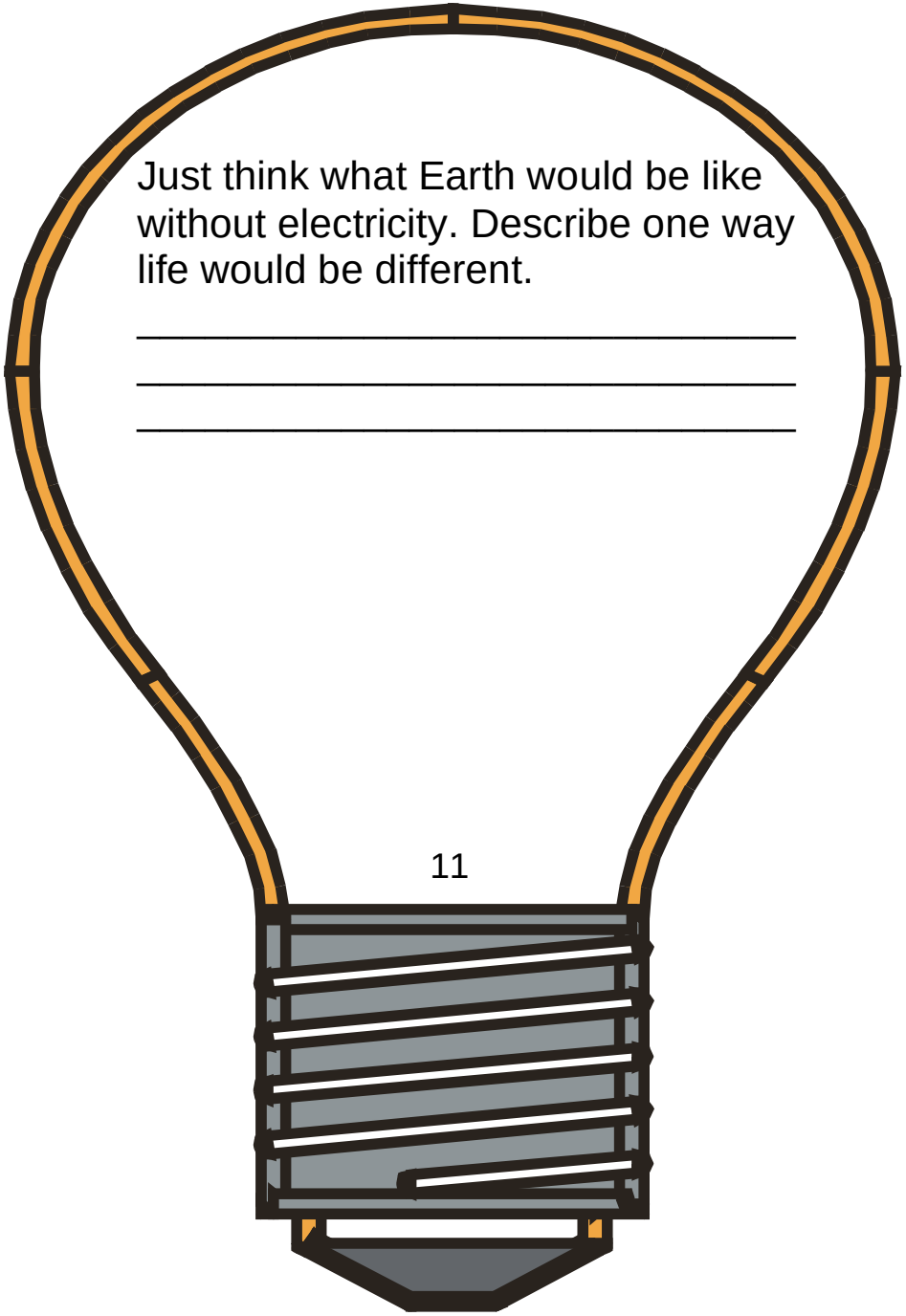

Draw and label at least two objects that use electricity to produce sound.
8


You are using batteries as a source of electricity to produce light in your lunar plant growth chamber. Why is this an important part of your chamber?
_____
_____
9



Electricity is important to everyone. We need to conserve it by turning lights and machines off when we are not using them.

10



Just think what Earth would be like without electricity. Describe one way life would be different.

_____

_____

_____

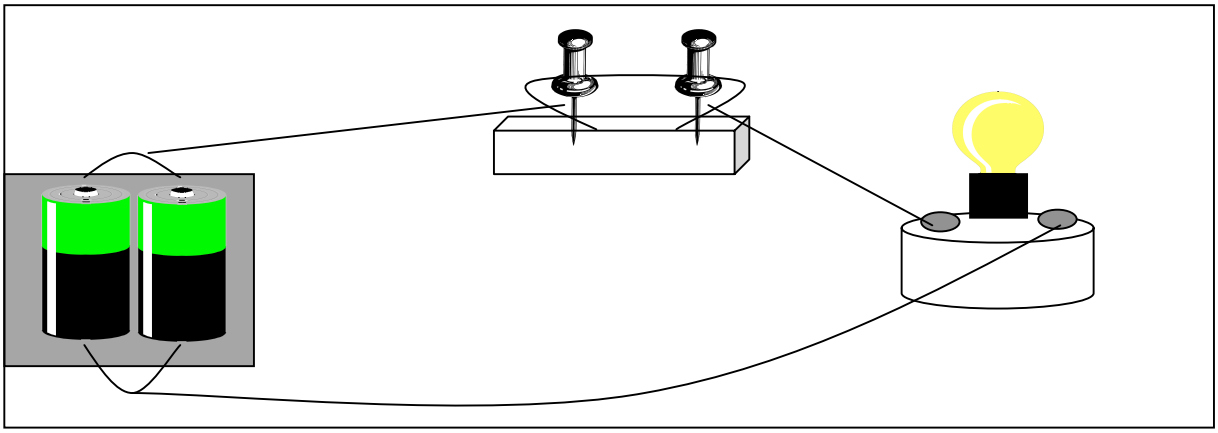
11

Name _____

1. What type of energy did you learn about?

2. What are two sources of electricity?

3. Look at the illustration of the electrical circuit below.
   - Label the following parts: batteries, light bulb, light socket, wires and switch.



4. Write a definition for each part of the circuit.
   - battery
   - light socket
   - light bulb
   - switch
   - wire

5. Will electricity flow through this circuit so that the light can turn on and off? Explain your answer.