Electrical Circuits

Teacher's Guide

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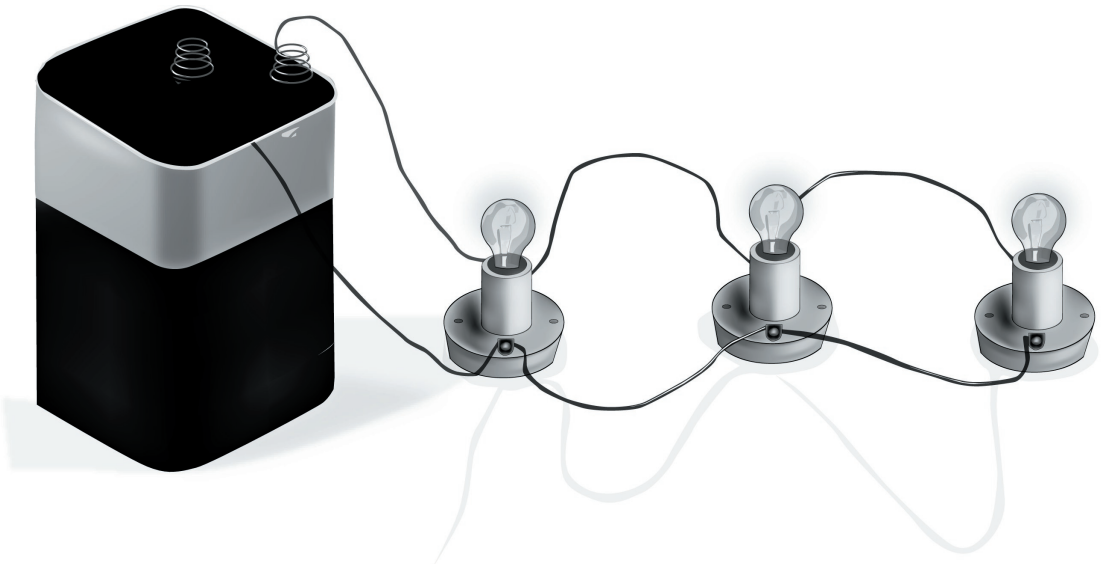

Elementary Science

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Table of Contents

National Standards Correlations

Benchmarks for Science Literacy
(Project 2061 – AAAS) Grades 3–5

Habits of Mind - Values and Attitudes (12A)
By the end of the fifth grade, students should be able to:
• Offer reasons for their findings and consider reasons suggested by others.

Habits of Mind - Manipulation and Observation (12C)
By the end of the fifth grade, students should be able to:
• Make safe electrical connections with various plugs, sockets, and terminals.

National Science Education Standards
(Content Standards: K–4, National Academy of Sciences)

Physical Science - Content Standard B
As a result of activities in grades K-4, all students should develop an understanding of:

Light, Heat, Electricity, and Magnetism
• Electricity in circuits can produce light, heat, sound, and magnetic forces. Electrical circuits require a complete loop through which an electrical current can pass.

Physical Science - Content Standard B
As a result of activities in grades 5-8, all students should develop an understanding of:

Transfer of Energy
• Electrical circuits provide a means of transferring electrical energy when heat, light, sounds, and chemical changes are produced.

Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students will be able to do the following:

- Define electric current as the continuous flow of electric charges through a material.
- Understand that protons and electrons possess a property called electric charge.
- Identify potential difference as the amount of work required to move a charge between two points.
- Understand that the greater the potential difference, the greater the current.
- Identify the volt as the unit of potential difference.
- Describe an electric circuit as a complete, closed path through which electric charges flow.
- Identify the three main components of an electric circuit - a source of energy; a load, or resistance; and a switch.
- Differentiate between open and closed circuits.
- Identify and differentiate between two major types of circuits: series circuits and parallel circuits.
- Describe the major disadvantage of series circuits and explain how this is resolved by parallel circuits.
- Explain how ground prongs, fuses, and circuit breakers serve as safety mechanisms in your home.
- Define a short circuit as an unintended path that allows current to bypass the loads in a circuit. Offer examples of how short circuits can occur.

Assessment

Preliminary Test (p. 14-15):

The Preliminary Test is an assessment tool designed to gain an understanding of students' preexisting knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Post-Test (p. 16-17):

The Post-Test can be utilized as an assessment tool following student completion of the program and student activities. The results of the Post-Test can be compared against the results of the Preliminary Test to assess student progress.

Video Review (p. 18):

The Video Review can be used as an assessment tool or as a student activity. There are two sections. The first part contains questions displayed during the program. The second part consists of a five-question video quiz to be answered at the end of the video.

Introducing the Program

Before viewing the video, ask students if they know what an electric circuit is, and if so, how they would describe it. Define an electric circuit as a complete, closed path through which electric charges flow. Also explain that objects that use electricity rely on electric circuits. Ask the class to make a list of all the objects in the classroom that contain electric circuits.

Explain that all electrical devices in the classroom are most likely connected to one or two circuits. Next, ask students to raise their hands if they have ever heard of a circuit being overloaded. If they have, it may have caused appliances to unexpectedly shut off in their home, and an adult may have had to flip a switch in a breaker box. Let them know that circuit breakers are one type of safety mechanisms that help to keep homes safe when too many appliances are being used at the same time, causing a circuit to overload and possibly overheat. Tell the students to watch the video to learn more about electric circuits.

Program Viewing Suggestions

The student master “Video Review” is provided (p. 18) for distribution to students. You may choose to have your students complete this Master while viewing the program or do so upon its conclusion.

The program is approximately 14 minutes in length and includes a five-question video quiz. Answers are not provided to the Video Quiz in the video, but are included in this guide on page 12. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.

Video Script

1. Have you ever looked behind a wall in your home to observe the maze of wires leading to outlets. . .
2. . . . and light fixtures?
3. Perhaps you have noticed the many wires in the engine of a car or truck.
4. If you have ever seen the inside of a radio or computer, you may have seen wires there, connected to various devices.
5. And if you have ever taken a walk around your neighborhood . . .
6. . . . or a drive, chances are you have seen electrical poles supporting long strands of wires.
7. These are all examples of electric circuits.
8. Electric circuits are very important to our daily lives.
9. Every time you flip a light switch, . . .
10. . . . turn on a computer, . . .
11. . . . or watch television, you are using electric circuits.
12. During the next few minutes, we are going to take a look at some of the characteristics and types of electric circuits, . . .
13. . . while exploring how electricity moves through them.
14. **Graphic Transition – Moving Charges and Electric Current**
15. If you have ever accidentally touched an electric fence surrounding livestock, you know from the pain you experienced that the wire contained electric current.
16. What exactly is electric current?
17. Simply put, electric current is the flow of electric charges through a material.
18. As you know, protons and electrons possess a property called electric charge.
19. When charges flow through a wire or another material, an electric current is created.
20. Electric current involves a continuous flow of charges,. . .
21. . . . much like this stream is a continuous flow of water.
22. But what makes electric charges move?
23. In order to make electric charges move, you need a device which produces energy, such as an electric generator or a battery, seen here.
24. **You Observe!** What happens when the wires are connected to the terminals on this battery?
25. As you can see in the graphic, electric charges move from one battery terminal, through the wire, to the other battery terminal.
26. This happens because something called an electric potential difference was created by the battery.
27. Electric potential difference is the amount of work required to move a charge between two points.
28. The unit of potential difference, or the energy per unit charge, is the volt.
29. The greater the electric potential difference, the greater the current.

Video Script

30. This 6 volt battery, for example, creates a greater electric potential difference. . .
31. . . . than this 1.5 volt battery.
32. Remember, batteries are just one way electric potential difference and electric current, are produced.
33. Let's now take a closer look at electric circuits.
34. Graphic Transition – Electric Circuits
35. The wiring in your house,. . .
36. . . . as well as the batteries and light bulb in this lantern, form what are called electric circuits.
37. An electric circuit is a complete, closed path through which electric charges flow.
38. Let's take a look at the parts of a circuit.
39. An electric circuit consists of a source of energy; a load, also referred to as resistance; and a switch.
40. In this circuit, the battery is the source of energy.
41. The plastic-coated strands contain metal wires.
42. This device is the switch.
43. And the light bulb is the resistance, or load.
44. **You Observe!** Why isn't the light bulb lit in this circuit?
45. This light bulb is not lit because the switch is open. This circuit is called an open circuit and current is not flowing.
46. The switch has to be closed to make a complete closed circuit. Now, current is flowing through the closed circuit.
47. Graphic Transition – Series Circuits
48. There are two major types of circuits: series circuits and. . .
49. . . . parallel circuits.
50. The type of circuit depends on how the parts of the circuits are arranged.
51. This is a series circuit. Notice how all the parts of the circuits are connected one after another.
52. There is only one path for the current to travel.
53. **You Predict!** What will happen to the circuit if this wire is disconnected from this bulb?
54. As you can see, not just the bulb to which the wire was connected went out, but all the bulbs went out.
55. This is a big disadvantage of series circuits – if there is a break anywhere in the circuit, the entire circuit fails to work.
56. Fortunately, another type of circuit solves this problem.
57. Graphic Transition – Parallel Circuits
58. When a light goes out in this chandelier, the other bulbs don't go out.
59. When a light in this chain of lights goes out, all the rest of the lights stay lit.
60. And when a light goes out in this room, the rest of the lights in the room remain operable.

Video Script

61. In these examples, the lights are wired in parallel circuits.
62. In a parallel circuit, different parts of the circuit are on separate branches.
63. Notice how there are a lot more wires in a parallel circuit than in a series circuit.
64. The separate branches allow the current to take several paths in the circuit.
65. In this parallel circuit, if one bulb goes out, the other bulbs stay lit.
66. The circuits in most buildings, including your home, are wired in parallel.
67. Let's now take a closer look at some of the other features of circuits in your home.
68. **Graphic Transition – Household Circuits**
69. Every year, hundreds of fires occur in buildings due to faulty wires – mostly old wiring.
70. Often, these fires are due to short circuits. A short circuit is an unintended path connecting one part of a circuit with another.
71. When a short circuit occurs in wires, the wires can overheat and start a fire.
72. One safety feature found in appliances such as refrigerators and microwaves is a third prong on the plug. This prong is called the ground prong.
73. The third ground prong is connected to a wire in the cable which, when plugged in to a socket, is connected to a ground, which carries no current.
74. The ground plug is designed to protect against short circuits.
75. If a short circuit occurs, the charge could flow into the shell of the appliance and the appliance might shock anyone touching it.
76. Fuses and circuit breakers are other safety mechanisms in your home.
77. If you were to run a microwave, a blender, and a toaster all at the same time, these appliances may suddenly stop working.
78. **You Decide!** Why did the appliances turn off?
79. The reason the appliances went off is because they overloaded the circuit, causing it to overheat.
80. This small mechanism, called a fuse, caused the current to stop in the circuit.
81. Fuses are safety mechanisms which shut off electric current when the current gets too hot.
82. Inside a fuse is a piece of thin metal which melts when too much current flows through it. This fuse has already melted.
83. Once a fuse has melted, it needs to be replaced with a new one.
84. Older buildings typically have fuses.
85. Modern buildings tend to have circuit breakers instead of fuses.
86. This is a breaker box containing several breakers.
87. When a circuit becomes overloaded, the circuit breaker flips and the current is shut off.
88. Circuit breakers are easier to use than fuses because they just need to be flipped back on if they go out.

Video Script

89. Graphic Transition – Summing Up

90. During the past few minutes, we have explored some of the fascinating characteristics of electric circuits.
91. The program began by describing electric current as the flow of electric charges through a material.
92. The basics of how electric current is produced were explained.
93. Components common in electric circuits were highlighted, including a source of energy, a resistance, wires, and a switch.
94. Open and closed circuits were also compared.
95. The arrangement and characteristics of both series circuits and parallel circuits were demonstrated.
96. Last, some of the aspects of household circuits were discussed, including fuses, breakers, and ground prongs.
97. So the next time you put batteries into a flashlight, . . .
98. . . . flip on a switch, . . .
99. . . . or put lights on a tree, think about some of the things we just discussed.
100. You just might think about electric circuits a little differently.

101. Graphic Transition – Video Assessment

Fill in the correct word to complete the sentence. Good luck and let's get started.

1. Electric _____ is the flow of electric charges.
2. The light bulb in this circuit is the _____.
3. The bulb is not lit because the circuit is _____.
4. This is a _____ circuit.
5. A circuit _____ prevents circuits from getting dangerously hot.

Answer Key to Student Assessments

Pre-Test (p. 14-15)

1. d - separate branches
2. c - short circuit
3. d - safety mechanisms
4. b - switch
5. c - electric current
6. d - voltage
7. a - open
8. c - hot
9. b - ground plug
10. b - battery
11. False
12. True
13. True
14. False
15. True
16. An electric current is the flow of electric charges through a material.
17. The three parts of an electric circuit are a switch; energy source; and load, or resistance.
18. Current cannot flow when an electric circuit is open.
19. Metal in a fuse melts when it becomes too hot, stopping the flow of current.
20. In series circuits, all parts are connected one after the other, so there is only one path on which current can flow. In parallel circuits, the parts of the circuit are on separate branches, so there are several paths on which current can flow.

Post-Test (p. 16-17)

1. c - electric current
2. a - open
3. b - battery
4. c - short circuit
5. c - hot
6. d - safety mechanisms
7. b - ground prong
8. d - separate branches
9. d - voltage
10. b - switch
11. True
12. True
13. False
14. True
15. False
16. Metal in a fuse melts when it becomes too hot, stopping the flow of current.
17. Current cannot flow when an electric circuit is open.
18. In series circuits, all parts are connected one after the other, so there is only one path on which current can flow. In parallel circuits, the parts of the circuit are on separate branches, so there are several paths on which current can flow.
19. The three parts of an electric circuit are a switch; energy source; and load, or resistance.
20. An electric current is the flow of electric charges through a material.

Video Review (p. 18)

1. Electric charges move from one battery terminal, through the wire, to the other battery terminal.
2. The light bulb is not lit because the switch is open.
3. All of the bulbs went out.
4. The appliances overloaded the circuit, causing it to overheat.

1. current
2. load, or resistance
3. open
4. series
5. breaker

Answer Key to Student Activities

Vocabulary (p. 19)

1. parallel circuit
2. volt
3. ground prong
4. electric current
5. circuit breaker
6. electric circuit
7. series circuit
8. potential difference
9. short circuit
10. fuse

Writing Activity (p. 20)

An electric **circuit** is a complete, closed path through which electric charges flow. An electric circuit has three main parts: an energy source; a **switch;** and a load, or **resistance**. A circuit must be **closed** in order for current to flow. There are two major types of circuits: series circuits and parallel circuits. In a series circuit, all parts of the circuit are connected one after the other. The disadvantage of **series** circuits is that there is only one path for current to travel, so if there is a break anywhere in the circuit, the entire circuit fails. In a **parallel** circuit, the parts of the circuit are on separate **branches**. This allows the current to take several paths in the circuit. A **short** circuit is an unintended path connecting two parts of a circuit. Short circuits can be dangerous and even cause a fire.

In Your Own Words (p. 20)

1. In a parallel circuit, parts of the circuit are on separate branches.
2. Fuses, circuit breakers, and ground prongs.
3. The major disadvantage of series circuits is that if there is a break anywhere in the circuit, the entire circuit will not work.

Energy Conservation (p. 25)

1. Nonrenewable resources are limited sources of energy. Coal and oil are examples.
2. Renewable resources are resources that can be used over and over again. Examples include hydro energy, solar energy, wind-generated energy, and bio energy.
3. Reasons to conserve nonrenewable resources include the limited amount of energy sources, to decrease pollution, and to save money.
4. Answers will vary.
5. Answers will vary.

Comparing Circuits (p. 22)

1. The bulbs become dimmer as more are added to the series circuit. This is because each bulb adds resistance, resulting in less current flowing to the bulb that is farthest from the energy source.
2. Unscrewing one bulb caused all of the bulbs to go out. This is because there was a break in the circuit, so current could not flow. Unscrewing a different bulb would also cause the circuit to go out.
3. The brightness of the bulbs did not change as more bulbs were added. This is because there are several paths in a parallel current, so current is allowed to flow directly to each bulb rather than traveling through others, as in a series circuit.
4. The rest of the bulbs remained lit. Unscrewing other bulbs would not have changed the outcome. Because there are several paths on which current can travel in a parallel circuit, one break in the circuit does not impact all of the loads.
5. In the diagram, students should label the batteries as the energy sources and each bulb as loads, or resistance.

Conductors and insulators (p. 24)

1. All or most of the materials that are labeled as conductors are metals.
2. Insulators are materials that prevent the flow of electrical current. Plastic and rubber materials are good insulators.
3. The brightness of the bulb indicates whether a material is a good conductor. The brighter the bulb, the better the conductor.
4. It is easy for electricity to pass through the human body because it is composed of 60% water, which is a good conductor.
5. The wires are conductors and the rubber is an insulator.

Pre-Test

Name _____

Circle the best answer for each of the following questions.

1. In a parallel circuit, different parts of the circuit are on:

   a. third prong b. electric current c. fuses d. separate branches

2. This is an unintended path that allows current to bypass the loads in a circuit:

   a. long circuit b. series circuit c. short circuit d. parallel circuit

3. Fuses, circuit breakers, and ground prongs are all:

   a. electric circuits b. parallel circuits c. short circuits d. safety mechanisms

4. An electric circuit consists of a source of energy; a load, or resistance; and a(n):

   a. electric circuit b. switch c. volt d. fuse

5. What is created when charges flow through a wire or another material?

   a. short circuit b. static electricity c. electric current d. lightning

6. The greater the potential difference, the greater the:

   a. circuit breaker b. short circuit c. electric circuit d. voltage

7. Electric current does not flow through this type of electric circuit:

   a. open b. series circuit c. parallel circuit d. closed circuit

8. Fuses shut off electric current when the current gets too:

   a. fast b. long c. hot d. short

9. What part of a plug protects against short circuits?

   a. fuse b. ground prong c. electric current d. static plug

10. In order to make electric charges move, you need a device that produces energy, such as an electric generator or a(n):

    a. appliance b. battery c. outlet d. ground prong

Pre-Test

Name _____

Write true or false next to each statement.

11. _____ A short circuit occurs when a switch in a circuit is open.

12. _____ A 6-volt battery has a greater potential difference than a 1.5-volt battery.

13. _____ In parallel circuits, branches allow the current to take several paths in the circuit.

14. _____ The two main kinds of circuits are short circuits and long circuits.

15. _____ A switch must be closed to create a complete, closed circuit.

Write a short answer for each of the following.

16. What is an electric current?

_____

_____

17. Name the main parts of an electric circuit.

_____

_____

18. What happens when an electric circuit is open?

_____

_____

19. How does a fuse work?

_____

_____

20. Describe the difference between series circuits and parallel circuits.

_____

_____

Post-Test

Name _____

Circle the best answer for each of the following questions.

1. What is created when charges flow through a wire or another material?

   a. short circuit b. static electricity c. electric current d. lightning

2. Electric current does not flow through this type of electric circuit:

   a. open b. series circuit c. parallel circuit d. closed circuit

3. In order to make electric charges move, you need a device that produces energy, such as an electric generator or a(n):

   a. appliance b. battery c. outlet d. ground prong

4. This is an unintended path that allows current to bypass the loads in a circuit:

   a. long circuit b. series circuit c. short circuit d. parallel circuit

5. Fuses shut off electric current when the current gets too:

   a. fast b. long c. hot d. short

6. Fuses, circuit breakers, and ground prongs are all:

   a. electric circuits b. parallel circuits c. short circuits d. safety mechanisms

7. What part of a plug protects against short circuits?

   a. fuse b. ground prong c. electric current d. static plug

8. In a parallel circuit, different parts of the circuit are on:

   a. third prong b. electric current c. fuses d. separate branches

9. The greater the potential difference, the greater the:

   a. circuit breaker b. short circuit c. electric circuit d. voltage

10. An electric circuit consists of a source of energy; a load, or resistance; and a(n):

    a. electric circuit b. switch c. volt d. fuse

Post-Test

Name _____

Write true or false next to each statement.

11. _____ In parallel circuits, branches allow the current to take several paths in the circuit.

12. _____ A switch must be closed to create a complete closed circuit.

13. _____ A short circuit occurs when a switch in a circuit is open.

14. _____ A 6-volt battery has a greater electric potential difference than a 1.5-volt battery.

15. _____ The two main kinds of circuits are short circuits and long circuits.

Write a short answer for each of the following.

16. How does a fuse work?

_____

_____

17. What happens when an electric circuit is open?

_____

_____

18. Describe the difference between series circuits and parallel circuits.

_____

_____

19. Name the main parts of an electric circuit.

_____

_____

20. What is an electric current?

_____

_____

Video Review

Name _____

While you watch the video, answer these questions:

1. **You Observe!** What happens when the wires are connected to the terminals on this battery?

_____

_____

_____

2. **You Observe!** Why isn't the light bulb lit in this circuit?

_____

_____

_____

3. **You Predict!** What will happen to the circuit if this wire is disconnected from this bulb?

_____

_____

_____

4. **You Decide!** Why did the appliances turn off?

_____

_____

_____

After you watch the video, test your knowledge with these questions.

1. Electric _____ is the flow of electric charges.

2. The light bulb in this circuit is the _____ .

3. The bulb is not lit because the circuit is _____ .

4. This is a _____ circuit.

5. A circuit _____ prevents circuits from getting dangerously hot.

Vocabulary

Name _____

Use these words to fill in the blanks next to the sentences below.

Words

circuit breaker electric circuit electric current potential difference fuse
ground prong parallel circuit series circuit short circuit volt

1. _____ A circuit in which the parts of the circuit are on separate branches.

2. _____ The unit of electric potential difference.

3. _____ The third prong on a plug that helps protect against short circuits.

4. _____ The flow of electric charges through a material.

5. _____ When a circuit becomes overloaded, this shuts off current by flipping a switch.

6. _____ A complete, closed path through which electric charges flow.

7. _____ A circuit in which all parts are connected one after another.

8. _____ The amount of work required to move a charge between two points.

9. _____ An unintended path that allows current to bypass the loads in a circuit.

10. _____ A thin piece of metal, added to circuits, that melts when the circuit becomes overloaded.

Writing Activity

Name _____

series	parallel	closed	switch
resistance	circuit	branches	short

Use the correct word from above to complete the sentences in the following paragraph.

An electric _____ is a complete, closed path through which electric charges flow. An electric circuit has three main parts: an energy source; a _____ ; and a load, or _____ . A circuit must be _____ for current to flow. There are two major types of circuits: series circuits and parallel circuits. In a series circuit, all parts of the circuit are connected one after the other. The disadvantage of _____ circuits is that there is only one path for current to travel, so if there is a break anywhere in the circuit, the entire circuit fails. In a _____ circuit, the parts of the circuit are on separate _____ . This allows the current to take several paths in the circuit. A _____ circuit is an unintended path connecting two parts of a circuit. Short circuits can be dangerous and even cause a fire.

In Your Own Words

1. Describe a parallel circuit.

_____

_____

_____

2. Name three electricity safety mechanisms found in homes.

_____

_____

_____

3. What is a major disadvantage of series circuits?

_____

_____

_____

Comparing Circuits

Name _____

Background: An electric circuit is a complete, closed path through which electric charges flow. An electric circuit consist of three parts: a source of energy; a switch; and a load, or resistance. There are two main types of electric circuits: parallel circuits and series circuits. The type of circuit is determined by how the parts of the circuit are arranged. In a series circuit, all parts of the circuit are connected one after the other, so there is only one path along which the current can flow. This means that if there is a break in one part of the circuit, the entire circuit will not work. In a parallel circuit, parts of the circuit are on separate branches, so there are many paths for the current to take. If there is a break in one part of the parallel circuit, current can continue to travel along other paths. Another disadvantage of series circuits is that there is greater resistance. Because the current must travel through several loads, or more resistance, there is less current once it reaches the final destination. Try the experiment below to learn more about electric circuits.

Materials:

- 6-volt battery
- 7 wires with alligator clips (To use wire without clips, remove plastic coating at both ends of the wire)
- 3 6-volt bulbs
- 3 bulb holders

Activity:

1. Begin by connecting one bulb to the battery. To do so, use one wire to connect the bulb to the positive (+) battery terminal and a second wire to connect it to the negative (-) terminal. Refer to diagram A on the following page. Notice the brightness of the bulb.
2. Add a second bulb to create a series circuit. See diagram B. Notice the brightness of both bulbs.
3. Add a third bulb to the series circuit (diagram C). Notice the brightness of the bulbs.
4. Unscrew one bulb. Observe what happened.
5. Reconnect the three bulbs to make a parallel circuit. Refer to diagram D for assistance. Notice the brightness of the bulbs.
6. Unscrew one bulb. Observe what happened.
7. Answer the questions on the following page.

Comparing Circuits

Name _____

Questions: Answer these questions on a separate page.

1. What happened to the brightness of the light bulbs when more were added to the series circuit? Why did this happen?
2. What happened to the bulbs when one bulb in the series circuit was disconnected? Why did this happen? Would the result be the same if a different bulb was unscrewed?
3. Compare the brightness of the bulbs in the parallel circuit to those in the series circuit. Explain why these are different.
4. What happened when a bulb was unscrewed in the parallel circuit? Explain why this is different to what happened in the series circuit. Would the result be the same if a different bulb was unscrewed?
5. In the diagrams below, label the sources of energy and the loads, or resistance.

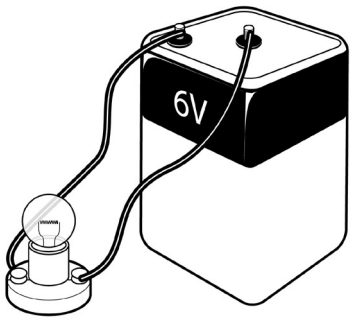

Diagram A

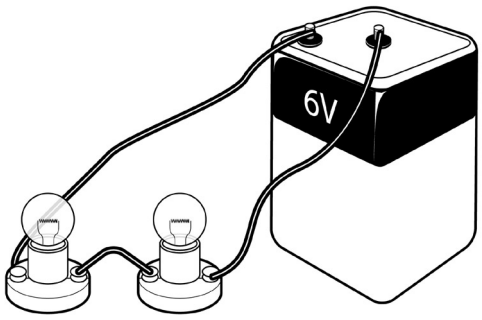

Diagram B

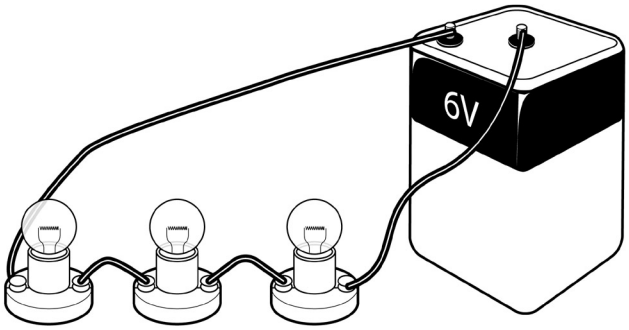

Diagram C

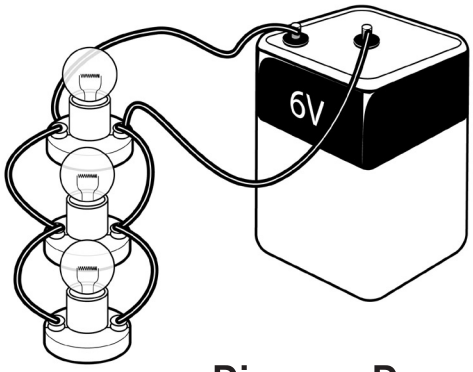

Diagram D

Conductors and Insulators

Name _____

Background: Electrical circuits are usually composed of two types of materials - conductors and insulators. **Conductors** are materials through which electric current can easily flow. Materials made of metals are good conductors. Electrical wiring is made of copper, a metal that easily conducts electricity. Water is a good conductor, which is why it is dangerous to swim during a lightning storm. **Insulators** are materials that prevent or reduce the flow of electrical current. Insulators are used to stop electricity from flowing to places that it shouldn't. Rubber and plastic are good insulators. Try the activity below to discover which materials make good conductors and which make good insulators.

Materials:

- 6-volt battery
- 3 wires with alligator clips at both ends
- 6-volt light bulb, screwed into light bulb holder
- Cutting board or other insulating material on which to do activity.
- Several materials to test. Examples are below:
  - nail
  - penny
  - paper
  - piece of rubber
  - large lego
  - block of wood
  - paper clip
  - aluminum foil
  - piece of fabric
  - rubber bands

Activity:

1. Before you begin, make a hypothesis (guess) about which materials will be good conductors and which will be good insulators. Record your hypothesis in the chart on the following page.
2. Attach the first wire to the positive (+) battery terminal and the other end to one side of the light bulb holder.
3. Attach the second wire to the negative (-) battery terminal.
4. Attach the third wire to the other side of the light bulb holder.
5. Attach the free ends of the two wires to opposite sides of the material that is being tested.

Conductors and Insulators

Name _____

Material	Hypothesis	Bulb brightness (off, dim, bright)	Conductor or insulator

Questions

1. What do most or all of the materials labeled as conductors have in common?

2. Define insulator and give examples from the experiment.

3. Were some conductors better than others? How could you tell?

4. The human body is made up of over 60% water. Do you think it is easy or difficult for electricity to travel through people. Why?

5. Many appliances in your home, such as lamps and televisions, have power cords. These cords have rubber on the outside and wires on the inside. Which of these materials is an insulator and which is a conductor?

Energy Conservation

Name _____

Directions: Read the information below. Answer the questions that follow on a separate piece of paper.

The electricity we use everyday is a form of energy. Have you ever thought about where the electricity in your homes or school comes from? Much of the electricity we use is generated by burning fossil fuels, such as coal and oil. However, burning fossil fuels pollutes the environment and fossil fuels are a nonrenewable resource. This means that once we run out of these resources, they are gone forever. It is important to conserve electricity so that we don't run out of energy sources and to limit pollution of the environment. Conserving energy also helps save money by reducing your family's electricity bill! Here are some tips on how you can conserve energy:

- Turn off the lights when you leave a room.
- If you have air conditioning in your house, try to use it as little as possible. Whenever possible, use the fan instead.
- Dry your clothes on a clothes line or clothes rack instead of using a dryer.
- Switch old bulbs with new compact fluorescent bulbs. These special bulbs use 75% less electricity than a standard bulb and are just as bright!
- Turn off electronics that you are not using, such as televisions, computers, and stereos. It's important to turn off the surge protector to which these electronics are connected. Some devices, such as modems, use energy all the time, even when they are turned off.
- Don't leave the refrigerator door open longer than necessary. Refrigerators use a lot of electricity, so it's important to make sure that they are not leaking cold air. To test your refrigerator, shut a piece of paper in the door. If you are able to pull the paper out without opening the door, your refrigerator is probably losing energy.
- Look at the energy bill with adults in your home and brainstorm ways you can each cut back your electricity use.

There is an alternative to creating electricity from nonrenewable resources - using renewable resources. Renewable resources are unlimited resources that can be used over and over again. Examples of nonrenewable energy sources include energy from the wind, energy from the sun (solar energy), energy from the water (hydro energy), and fuel made from plants (bio energy). While these energy resources are better for the environment, they each have drawbacks, making it important to conserve *all* sources of electricity.

Questions:

1. Define and provide examples of a nonrenewable source of electricity.
2. Define and provide examples of renewable sources of energy.
3. Why is it important to conserve nonrenewable electricity sources?
4. Give an example of how your family conserves electricity.
5. Identify one way your school can conserve electricity.