UNIT B Lighten Up! (page 88)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
30 min	• variety of electric devices, such as – multimeter – light switch (wall switch and lab switch) – extension cord – transformer (adapter) – clock radio – small appliances	OHT B–1 Electricity and Electric Devices

Overall Expectations

PECV.01 – describe the characteristics of electrical circuits
PECV.02 – investigate simple electrical circuits, using safe practices
PECV.03 – analyze the practical uses of electrical circuits and their impact on daily life
SILV.01 – illustrate how science is a part of daily life
SILV.02 – use appropriate scientific skills, tools, and safety procedures to investigate problems
SILV.03 – examine the connections between science and activities in daily life
CPMV.01 – explain the characteristics and classification of common materials, using appropriate scientific terminology
CPMV.02 – investigate the physical and chemical properties of common materials through laboratory activities
CPMV.03 – analyze how the use of various materials is based on their physical and chemical properties
BSAV.03 – analyze how personal health and safety in everyday life and in the workplace are protected through the proper use of equipment and safety practices

Activity Planning Notes

The unit opener will provide you with some idea of what students already know about electricity and is a good opportunity to encourage students to participate in class discussions. Ask students to share their prior knowledge of electricity and the various electric devices that they commonly use. Have students identify what each device does for them (entertainment, heating, lighting, food preparation, and so on). Expect some non-science terms to be used by the students.

Have some electric equipment and devices on display and encourage discussion about their function. Some of this equipment may be available in other departments of the school (e.g., Physics or Technological Studies departments).

You may wish to use **OHT B–1 Electricity and Electric Devices** and brainstorm as a class the first stages of a mind map. Record students' suggestions on the mind map, and then have them copy the map onto page 88. They can work independently to add a few more terms to the map.

Instruct students as follows:
- The first level of the mind map should include points about safety and electric devices.
- The second level should be what the device does.
- The mind map should have at least two levels and have arrows to link ideas from the central idea outward.

Accommodations

- Have cards with the terms and names of devices for ESL and other students to copy.
- If students come from different countries, discuss the different types of electric outlets they may have used (Europe, Asia, and Africa have different outlets and/or current than North America).

Diagnostic Assessment

The brainstorming with the class should give you a sense of students' general understanding of electricity and electric devices. Some things to consider are as follows.

- Be aware that students will use familiar terms to describe electric devices and will relate their own experiences and background to the subject matter. Some terms will be foreign to them. For example, some students will have heard terms like 120 volts and 240 volts but may not understand what they mean.
- Discuss students' knowledge of safety precautions that they should take when they work with electricity (e.g., the danger posed by water near live wires).
- Students will often associate electricity with light but not with other forms of energy conversions (e.g., heat or motion).

Technology Links

- For more information on electricity, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Electricity at Work.

Science and Literacy Link Answer (page 89)

1. Encourage students to use at least three sentences in their answer to explain their choice and reasoning. Discuss whether their choice of device was based on frequency of use, necessity, or how it enhances their life.

Activity Preparation for Chapter 5

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
What's Going On? Have You Got a Light? (page 92) (TR page 118)	• 2 days before – Check that batteries, alligator clips, and light bulbs are functioning properly.	• 45 min	• Instruct students to be careful not to "short" the circuit by connecting the ends of the battery to a wire. • Have extra equipment on hand in case of accidental damage.
What's Going On? Make the Switch! (page 96) (TR page 119)	• 1 day before – Gather materials and construct switch. – Photocopy **Assessment Master 11 Using Tools and Equipment Checklist** (optional).	• 10 min if a demo • 40 min if class builds the switch	• This activity can be done as a teacher demonstration with students answering the questions. Alternatively, it can be done as a lab in which students construct the switch and make observations.
Find Out: What Materials Conduct? (page 98) (TR page 123)	• 1 day before – Collect materials. – Check light bulbs and batteries to ensure they are functioning. – Photocopy any assessment masters you decide to use.	• 45 min	• Start with a demonstration to show students how to set up the apparatus. Demonstrate how to attach the clips firmly to the test materials.

Materials Needed for Chapter 5

Activity/Investigation	Apparatus	Materials	Blackline Masters
What's Going On? Have You Got a Light? (page 92) (TR page 118)	For each group: • 1.5 V D-cell battery in a holder • 2 wires with alligator clips • 1.5 V light bulb		**Optional** OHT B–2 Open and Closed Circuits
What's Going On? Make the Switch! (page 96) (TR page 119)	For each group or as a demo: • 2.0 V penlight bulb • 3 –15 cm pieces of insulated wire • small block of wood • 2 thumbtacks	For each group or as a demo: • tape • small piece of thin, flat metal or foil	**Optional** Assessment Master 11 Using Tools and Equipment Checklist
Find Out: What Materials Conduct? (page 98) (TR page 123)	For each group: • 3 wires with alligator clips • 1.5 V light bulb in holder • 1.5 V battery in holder	For each group: • rubber plug • piece of wood (e.g., wooden splint) • penny coin • nickel coin **Optional** • graphite lead (pencil sharpened at both ends to expose the graphite) • aluminum foil • copper wire • 6 cm nail	**Optional** Assessment Master 11 Using Tools and Equipment Checklist Assessment Master 13 Fair Test Checklist

CHAPTER 5 Electricity on the Move (page 90)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
15 min	• overhead projector and markers	OHT 7 How Do You Use Electricity?

Overall Expectations

PECV.01 – describe the characteristics of electrical circuits
PECV.02 – investigate simple electrical circuits, using safe practices
PECV.03 – analyze the practical uses of electrical circuits and their impact on daily life
SILV.01 – illustrate how science is a part of daily life
SILV.02 – use appropriate scientific skills, tools, and safety procedures to investigate problems
SILV.03 – examine the connections between science and activities in daily life
BSAV.03 – analyze how personal health and safety in everyday life and in the workplace are protected through the proper use of equipment and safety practices

Technology Links

- For more information about the 1998 ice storm, go to **www.mcgrawhill.ca/books/Se9** and follow the links to 1998 Ice Storm.
- To learn more about the 2003 blackout, go to **www.mcgrawhill.ca/books/Se9** and follow the links to 2003 Blackout.

Activity Planning Notes

Use **OHT 7 How Do You Use Electricity?** and circle the devices as students study the graphic. Discussions could include a count of how many electric devices students used before coming to school. Discuss how their lives would be different without electric devices. Remind students of the ice storm of 1998, in which many Canadian households were without electricity for several weeks, or of the 2003 blackout, when many motorists were stranded on the highway because, without electricity, they could not fill up their gas tanks. If possible, share news stories published at that time.

Reading Icon Answer (page 90)

1. refrigerator, microwave oven, radio, school bus, stove, oven, cell phone, toaster, lights, CD player. Students might also mention electric transmission wires and electric outlets.

Check Your Understanding Answers (page 90)

2. control, change

3. Answers may vary. For example:

a) blow dryer; let my hair dry naturally

b) electric toothbrush; use a manual toothbrush

c) cell phone; go over to my friend's house to talk

5.1 What Is an Electric Circuit? (page 91)

SUGGESTED TIMING

15 min for introduction
45 min for What's Going On? Have You Got a Light?
30–40 min for pages 93–95
10 min for What's Going On? Make the Switch! (if demo); 40 min if class builds the switch

MATERIALS

- switch

BLACKLINE MASTERS

BLM 5–1 Circuit Symbols Activity
BLM 5–2 Label the Picture
BLM 5–3 Circuit Diagrams
BLM 5–4 Inside a Light Switch
OHT B–2 Open and Closed Circuits
OHT B–3 Circuit Symbols
OHT 7 How Do You Use Electricity?
OHT 8 What Type of Electricity?
Assessment Master 11 Using Tools and Equipment Checklist
Assessment Master 12 Using Tools and Equipment Rubric

Specific Expectations

PEC1.01 – use scientific terminology during investigations to describe basic electrical concepts and related units of measure
PEC1.02 – demonstrate an understanding that electrical energy can be converted into other forms of usable energy within electrical circuits
PEC1.04 – use a variety of symbols to represent different components in electrical circuits
PEC2.02 – design, build, and test an electrical circuit to investigate the chosen question, using appropriate safety procedures
PEC2.03 – conduct investigations, using electrical materials, tools, and equipment safely
PEC2.05 – extract and interpret information from instructions and manuals for circuits and electrical devices
PEC2.06 – communicate plans and results of investigations about electrical circuits, using a variety of oral, written, and graphic formats
PEC3.01 – identify circuits and their components in household and workplace settings
SIL2.03 – conduct investigations safely, using appropriate lab equipment
SIL2.04 – observe and record data, using a variety of formats, including the use of SI units, where appropriate
SIL2.05 – assess data to make inferences and conclusions and to answer questions and refine procedures
SIL2.06 – communicate plans, observations, and results using a variety of oral, written, and graphic representations, and including the use of SI units, where appropriate

Key Terms Teaching Strategies

Begin making an electricity word wall using only the key terms bolded in the text on page 91, and adding the others as they are encountered through the chapter. Include a sketch next to each word to serve as a visual reminder to students.

Accommodations

- Encourage ESL/ESD Learners to include a sketch along with the definition of each term and use this as a reference.

Reading Icon Answers (page 91)

4. a) static electricity

b) electric current

Reading Icon Answer (page 94)

1. Look for the following labels.
- load (lightbulb)
- switch (switch)
- source (battery)
- conductor (wire)

Reading Icon Answers (page 97)

1. Look for the following labels.
- open (bridge opened up)
- closed (bridge is closed)

2. Look for the following labels.
- switch off (bridge opened up)
- switch on (bridge closed)

Activity Planning Notes

Discuss students' experience with static electricity and static shocks.

Possible demonstrations: Consult with a Physics teacher as to whether materials are available for demonstrations using a Tesla coil, a Van de Graaff generator, and/or pith ball electroscopes. Another demonstration of how a charged object can attract a neutral object is to have a thin stream of water bend toward a charged rod. Have rolling races with static electricity: students rub two different materials together and roll pop cans across a table after charging their objects. Demonstrations illustrating the difference between static electricity and current electricity would be very helpful to the students. These demos are great attention grabbers and students love them.

After completing the introduction on page 91, do the What's Going On? activity on page 92, then discuss the materials on pages 93 to 95 before doing the What's Going On? on page 96. After taking up the activity, discuss what is inside a light switch on page 97.

Note: There are two kinds of switches (open and closed). The switch symbol shown on page 95 is an example of an open switch. Refer to **OHT B–3 Circuit Symbols** for an example of a closed switch symbol.

Neatness is important in teaching circuit diagrams. Ensure that your lines are always straight and that they are not cramped for space. A large diagram is better than a small one. Whenever possible, use different colours of chalk/pens to illustrate the various parts of the circuit. Colour may also be used to illustrate that a bulb is lit. Battery arrangement will not be emphasized at this point in the unit, but will be addressed later. Students need only to identify how many batteries are present in a circuit at this point. Connection dots should be drawn whenever wires are joined together (for example, in a "T" junction).

The student resource does not specify whether circuit diagrams should be drawn with the source on the left-hand side of the circuit, or on the top of the circuit. The former is scientific practice, the latter is standard professional practice. Note

that no differentiation has been made between a "cell" and a "battery." A battery is made up of multiple cells.

Use **BLM 5–1 Circuit Symbols Activity**, an activity in which students are provided with an illustration of a circuit and asked to physically place symbol cards over the appropriate circuit components. Students could also complete **BLM 5–3 Circuit Diagrams**.

Have a switch available for students to see and dissect. Students need to understand that there are different types of switches available commercially and that they all work on the same principle.

You may find the following blackline masters and overhead transparencies useful:
- **BLM 5–1 Circuit Symbols Activity**
- **BLM 5–2 Label the Picture**
- **BLM 5–3 Circuit Diagrams**
- **BLM 5–4 Inside a Light Switch**
- **OHT B–2 Open and Closed Circuits**
- **OHT B–3 Circuit Symbols**
- **OHT 7 How Do You Use Electricity?**
- **OHT 8 What Type of Electricity?**

Accommodations

- Use **OHT 8 What Type of Electricity?** to discuss what is happening in each picture at the bottom of page 91.
- Provide sample drawings on the chalkboard for students to compare to their work.
- Provide **BLM 5–2 Label the Picture** to help students understand the terminology introduced.
- Students with vision challenges might benefit from using **BLM 5–4 Inside a Light Switch**, which shows an enlarged version of the diagrams on page 97. You might convert this diagram into an overhead transparency to share with students.

Technology Links

- For more information on static electricity, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Static Electricity.

Check Your Understanding Answers (page 91)

5. Look for the following labels.
- static electricity (lightning)
- current electricity (flashlight)
- current electricity (computer)
- static electricity (balloon)

Check Your Understanding Answers (page 93)

1. a) Electric current flows in a closed circuit.

b) Electric current does not flow in an open circuit.

Making Connections Answers (page 93)

2. a) open

b) There is a gap.

Check Your Understanding Answers (page 94)

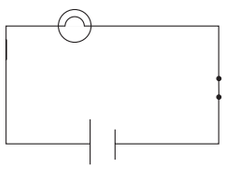
2. a) source; supplies electric energy

b) load; changes electric energy into light energy

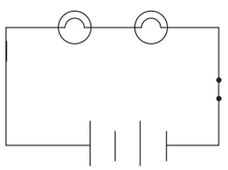
c) switch; opens and closes the circuit

Check Your Understanding Answers (page 95)

3. a)



b)



4. a) 4

b) 3

c) 2

Check Your Understanding Answer (page 97)

3. Answers are in italics. When the metal parts inside a light switch touch, the circuit is *closed*. *Electric current* flows and the light is *on*. When the metal parts do not touch, the circuit is *open*. The light is *off* because *no electric current* flows.

What's Going On? Activity (page 92)

Have You Got a Light?

Purpose

- Students are introduced to the apparatus used in simple circuits to demonstrate the flow of current.

Science Background

If you would like to provide students with a brief overview of atomic structure, share the following points:

- Matter is everything around you. Scientists picture matter as being made up of very tiny particles called atoms. The centre of an atom is called the nucleus. Electrons move around the nucleus, much like planets move around the Sun. Electrons never stop moving. In static electricity, electrons from one place move to another place and then stay in that location.
- The three laws of electrostatics are
  - like charges repel
  - unlike charges attract
  - a charged object can attract a neutral (uncharged) object

Note: There is confusion about the term "electricity" and how to define it. A useful way of thinking about it is this: electricity is a field of study; electric current or static electric charge is what is studied. The student resource uses the term "electric current" throughout. That is, electric current (not electricity) flows through a circuit. Scientific practice is to consider the flow of current as the flow of electrons (negative charge); however, functional electronics and the electrical professions work with conventional current, defined as the flow of positive charge. Electron flow is defined as the flow of electrons from the negative terminal to the positive terminal. Conventional current flow (as defined by electricians) is the flow of current from the positive terminal to the negative terminal. Physics courses use the definition of conventional current flow.

Students will discover that electric current travels through a path they construct containing

- a power source (such as a battery) that gives the circuit its energy
- a device (such as a light bulb) that uses the energy
- wires that allow the energy to be passed from the source to the device (load)

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 days before	• Check that batteries, alligator clips, and light bulbs are functioning properly.

APPARATUS	MATERIALS
• 1.5 V D-cell battery in a holder • 2 wires with alligator clips • 1.5 V light bulb	

Suggested Timing

45 min

Safety Precautions 

- Instruct students to be careful not to "short" the circuit by connecting the ends of the battery to a wire.
- Remind students to clean up their work area and wash their hands when they are finished.

Activity Planning Notes

Demonstrate how to connect the apparatus. It is important for the students to see where the alligator clips are connected. Try to observe and assist as many students as possible.

Have extra equipment on hand in case of accidental damage.

Accommodations

- Provide **OHT B–2 Open and Closed Circuits** for students who need help in understanding how to arrange the components, or pair these students with a partner who can show them. Make sure all students have the opportunity to make the connections themselves and observe the light bulb lighting up.

What Did You Learn? Answers (page 92)

3. All successful arrangements form a closed loop like the closed circuit diagram on page 93.

4. The bulb did not light when the connections were not complete. Current could not flow through all parts.

Activity Wrap-up

- Discuss activity successes and failures with students.

What's Going On? Activity (page 96)

Make the Switch!

Purpose

- Students observe how a switch controls the current flow.

Science Background

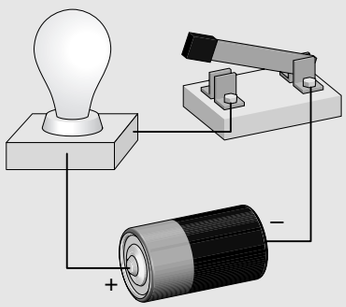
A switch works by opening and closing a circuit. When the switch is closed (both ends touch the wires), electrons carrying energy are allowed through and the circuit is complete. When the switch is open, energy cannot be delivered to the loads and the circuit is incomplete.

Procedure to Make the Switch

- Coil a small amount of bare wire around each thumbtack.
- Stick one thumbtack in the block of wood.
- Push the second thumbtack through the thin piece of flat metal or foil.
- Push the second thumbtack into the wood so that the piece of metal can touch the first thumbtack.

The illustration shown below is a more elaborate switch that you may wish to build.

- You should now have two free wires that can be connected to a load and a battery.



Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	• Gather materials and construct switch. • Photocopy **Assessment Master 11 Using Tools and Equipment Checklist** (optional).

APPARATUS	MATERIALS
• 2.0 V penlight bulb • 3 –15 cm pieces of insulated wire • small block of wood • 2 thumbtacks	• tape • small piece of thin, flat metal or foil

Suggested Timing

10 min as demo; 40 min if class builds the switch

Safety Precautions


- Ensure that students are careful with the tacks and report any injuries.
- Remind students to clean up their work area and wash their hands when finished.

Activity Planning Notes

This activity can be done as a teacher demonstration with students answering the questions. Alternatively, it can be done as a lab where students construct the switch and make observations. The latter will take more class time but is very worthwhile. Students should see a model of the switch before they begin building the switch.

Accommodations

- Pictures or a model of the switch will be helpful for some students. Students can work in pairs and assist each other with understanding the procedure and their observations.

What Did You Observe? Answers (page 96)

4. The light bulb went on.

5. The light bulb went off.

6. The circuit was open when the foil did not touch both tacks. The circuit was closed when the foil touched both tacks. I know because the bulb went on and off.

Activity Wrap-up

- Students can work in pairs to generate questions about switches and how they work.
- Students can make a list of alternative materials to use in a switch.
- If students have made their own switches, you might wish to have them complete **Assessment Master 11 Using Tools and Equipment Checklist**.

Ongoing Assessment

- If students have made their own switches you might use **Assessment Master 12 Using Tools and Equipment Rubric**.

Technology Links

- For more information on making a battery that works with air and salt water, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Saltwater Battery.
- To download free circuit building software, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Crocodile Clips.

Alternative Activities

- Students may be interested in researching careers related to electricity. They can discover the type of training needed and the typical daily duties of an occupation. You may be able to arrange to have an electrician come to visit the class and answer questions about safety with electricity.
- Consider showing the class a video about electricity, such as one of the following:
  – Bill Nye the Science Guy: *Electrical Current*, 26 min, Magic Lantern Communications Ltd. 2004.
  – Bill Nye the Science Guy: *Magnetism/Static Electricity*, 52 min, Magic Lantern Communications Ltd. 1995.
- Use some or all of the activities in the following Physics *ActiveFolders*: Electricity.

5.2 Controlling Where Electricity Goes (page 98)

SUGGESTED TIMING

15 min for introduction
45 min for Find Out
25 min for pages 100–101

MATERIALS

- examples of good and fair conductors
- examples of insulators

BLACKLINE MASTERS

Assessment Master 11 Using Tools and Equipment Checklist
Assessment Master 12 Using Tools and Equipment Rubric
Assessment Master 13 Fair Test Checklist
Assessment Master 14 Fair Test Rubric
Assessment Master 17 Poster Checklist
Assessment Master 18 Poster Rubric

Specific Expectations

PEC1.01 – use scientific terminology during investigations to describe basic electrical concepts and related units of measure
PEC1.04 – use a variety of symbols to represent different components in electrical circuits
PEC2.02 – design, build, and test an electrical circuit to investigate the chosen question, using appropriate safety procedures
PEC2.03 – conduct investigations, using electrical materials, tools, and equipment safely
PEC2.05 – extract and interpret information from instructions and manuals for circuits and electrical devices
PEC2.06 – communicate plans and results of investigations about electrical circuits, using a variety of oral, written, and graphic formats
PEC3.01 – identify circuits and their components in household and workplace settings
SIL2.03 – conduct investigations safely, using appropriate lab equipment
SIL2.04 – observe and record data, using a variety of formats, including the use of SI units, where appropriate
SIL2.05 – assess data to make inferences and conclusions and to answer questions and refine procedures
SIL2.06 – communicate plans, observations, and results using a variety of oral, written, and graphic representations, and including the use of SI units, where appropriate
SIL3.03 – demonstrate an understanding of how problem-solving and decision-making activities in the workplace use scientific process skills

Key Terms Teaching Strategies

Add the new list of key terms to the word wall that you began at the start of the unit. Make this an ongoing process to help build students' vocabulary skills.

Lead a discussion about the key terms. Students will recognize most of these words and should be able to share their understanding of them. Students may be familiar with other meanings for "conductors," and may think that "insulators" only refer to heat insulation.

Reading Icon Answer (page 100)

1. The main difference between conductors and insulators is that conductors let electric current flow very easily through them.

Activity Planning Notes

As a class, read the two opening paragraphs on page 98. Students can skim through the Find Out activity, and then state the main idea of the activity in their own words.

Have them do the Find Out starting on page 98, and then do the work on conductors, insulators, and safety on pages 100 and 101.

Accommodations

- Provide pictures of insulators that are used in industry, such as ceramic coils or older glass insulators.
- Provide exemplars of student work as well as many graphics.
- Students should work in groups whenever possible.

Have examples of good and fair conductors and insulators to demonstrate how current flows through them. The bulb will light up at various intensities. Use the intensity of light to demonstrate the effectiveness of the conductor.

Students may be surprised to learn that a current of 1 A used to light a 100 W bulb is enough current to kill 20 people. A current of 50 milliamps can cause your heart to stop beating.

Check Your Understanding Answers (page 100)

2. A conductor is a material that lets electric current flow through it. Metals are conductors.

3. An insulator is a material that hardly lets any electric current flow through it. Rubber, glass, and plastic are examples of insulators.

Making Connections Answers (page 100)

4. Copper is a conductor. Rubber and plastic are insulators.

5. No. You could not build a working electric circuit using glass rods as the conductors because glass is an insulator.

Making Connections Answer (page 101)

6. Bryan should turn the microwave oven off and unplug it by pulling on the plug, not the cord. He should be very careful not to touch the exposed wire.

Find Out Activity (page 98)

What Materials Conduct?

Purpose

- Students gain an understanding of what is required to conduct electricity. They observe how conductors and insulators affect the flow of electricity.

Science Background

Certain materials allow electric current to pass through them easily. These materials are called conductors. All metals are conductors.

Imagine that you are on a newly paved road. You would find driving on it easy. Now imagine that you are on a gravel road. It would be more difficult to drive on that road. A good conductor is like a paved road for electric current, whereas a poor conductor is like the gravel road for the electric current. Some materials allow hardly any electric current to pass through them. These materials are called insulators. They are roadblocks for electron traffic! Examples of insulators are rubber, plastics, and wood.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	• Collect materials. • Check light bulbs and batteries to ensure they are functioning. • Photocopy any assessment masters you decide to use.

APPARATUS	MATERIALS
• 3 wires with alligator clips • 1.5 V light bulb in holder • 1.5 V battery in holder	• rubber plug • piece of wood (e.g., wooden splint) • penny coin • nickel coin **Optional** • graphite lead (pencil sharpened at both ends to expose the graphite) • aluminum foil • copper wire • 6 cm nail

Suggested Timing

45 min

Safety Precautions

- Coach students to be careful with sharp objects.
- Do not use more than one battery or a lower voltage bulb. Similarly, do not use a higher voltage battery.
- Remind students to clean up the work area and wash their hands thoroughly after this activity.

Activity Planning Notes

Start with a demonstration to show students how to set up the apparatus. Demonstrate how to attach the clips firmly to the test materials.

Accommodations

- Have students work in pairs whenever possible.
- Show possible answers that could be used in their observations table (e.g., check marks, sentences).

What Did You Observe? Answer (page 99)

Test Materials	Observations
No item	Bulb did not light.
Rubber	Bulb did not light.
Wood	Bulb did not light.
Penny	Bulb did light up.
Nickel	Bulb did light up.

What Did You Discover? Answers (page 99)

7. The penny and the nickel allowed electric current to flow through them.

8. It helps to make the activity a fair test by showing whether electric current can flow without a test item.

Activity Wrap-up

- Discuss other types of materials that conduct or insulate and could have been used for this activity.
- Draw comparisons that metals are good conductors and that non-metals are poor (or non-) conductors but good insulators. For example, graphite in pencils can conduct electricity very well. Identify the use of some poor conductors in industry, such as silicon chips for computing (semi-conductors).

Ongoing Assessment

- You may wish to have students complete **Assessment Master 11 Using Tools and Equipment Checklist** and/or **Assessment Master 13 Fair Test Checklist**.
- You may wish to use **Assessment Master 12 Using Tools and Equipment Rubric** and/or **Assessment Master 14 Fair Test Rubric** to assess students' work during the Find Out activity.
- You may wish to use **Assessment Master 18 Poster Rubric** to assess students' posters.

Technology Links

- For more information on safety and electricity, as well as electrical standards and installations, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Home Safety, Worker Safety, and Play Safety.

Alternative Activities

- Discuss other electricity safety points, such as the following.
  - Never mix electricity with water! Do not use electric devices if you are wet or near water.
  - Do not use devices that have a frayed or exposed power cord.
  - Never remove the third prong from a three-prong plug.
  - Do not put anything into an electric outlet except a proper plug for an electric device or a plastic or rubber plug guard.
  - Do not overload an electric circuit
  - Use only properly certified products such as equipment that has the CSA (Canadian Standards Association) mark. You may wish to have students search for the CSA symbol on electric devices.

- Have students work with partners to create electricity safety posters that can be placed around the school or in the local community. You may wish to have students complete **Assessment Master 17 Poster Checklist**.
- Use some or all of the activities in the following Physics *ActiveFolders*: Electricity.

5.3 Changing Electric Energy (page 102)

SUGGESTED TIMING
75 min

BLACKLINE MASTERS
BLM 5–5 Energy Conversions

Specific Expectations

PEC1.01 – use scientific terminology during investigations to describe basic electrical concepts and related units of measure
PEC1.02 – demonstrate an understanding that electrical energy can be converted into other forms of usable energy within electrical circuits
PEC1.03 – identify how household and workplace electrical devices operate by converting energy to another form
PEC1.04 – use a variety of symbols to represent different components in electrical circuits
PEC2.05 – extract and interpret information from instructions and manuals for circuits and electrical devices
PEC3.01 – identify circuits and their components in household and workplace settings

Key Terms Teaching Strategies

Add the new terms to the word wall. You may wish to have students develop two sets of cards. The first set will have the key terms clearly printed. The second set will provide a clear visual or brief definition of the key term. Have students play a memory game during which they couple the right term with the correct visual or definition.

Activity Planning Notes

Start the lesson by asking a diagnostic question. For example, you could ask students if they know about different forms of energy or if they use only one form of energy. Students will most likely not know the definition of energy as "the ability to do work."

Use **BLM 5–5 Energy Conversions** as a source for discussion of energy conversions.

Accommodations

- If students have difficulty with the concept of conversion, ask them to analyze a number of appliances by asking
  – What goes in? (electricity)
  – What comes out? (sound, heat, motion)
  Point out that within each device the electricity is converted (changed) into some other form of energy.

Technology Links

- For more information on renewal sources of electric energy, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Renewable Energy.

Check your Understanding Answers (page 102)

1. Answers will vary for c) and d).

a) electric heater; heat energy

b) power saw; motion

c) radio; sound

d) desk lamp; light

Check Your Understanding Answers (page 103)

2. Look for the following labels.

a) chemical energy → electric energy (battery symbol)

b) electric energy → light energy (bulb symbol)

Making Connections Answer (page 103)

3. The energy conversion that takes place is motion to electricity to light. **Note:** Some students will have experience with this device, called a "dynamo." The answer to this question can lead to interesting discussions about electric energy production.

Chapter 5 Review (page 104)

SUGGESTED TIMING

45 min to complete and take up the review, and assign the Practice Test

BLACKLINE MASTERS

Master 3 Certificate
Master 4 List of Skills
BLM 5–6 Chapter 5 Word Puzzle
BLM 5–7 Chapter 5 Practice Test
BLM 5–8 Chapter 5 Test

Accommodations

- Allow students to make a chapter summary page of the key ideas/skills from the chapter. The back of the student resource provides space to do this. Alternatively, you might develop a chapter summary as an entire class.
- If students have difficulty with a particular review question, use the Review Guide to identify the section they need to review.
- **BLM 5–6 Chapter 5 Word Puzzle** can be used to help students review all of the key terms from Chapter 5.
- **BLM 5–7 Chapter 5 Practice Test** can be customized to produce extra reinforcement questions.

Using the Chapter Review

Depending on your class, students should be able to work through the review at their own pace. In order to have success with the Chapter Review, some students may need to do it in chunks, by completing several questions and then taking them up before continuing. This process will prevent students from completing many questions incorrectly.

To provide additional reinforcement of key terms, have students complete **BLM 5–6 Chapter 5 Word Puzzle**. Once the review is completed and taken up, assign **BLM 5–7 Chapter 5 Practice Test** and have students work individually. They may wish to use their completed review to help them.

Review Guide

Question	Section(s)	Refer to
1	5.1	Controlling Electric Energy (page 94)
2	5.1	Controlling Electric Energy (page 94)
3	5.2	Conduct Yourself Safely! (page 101)
4	5.2	Conductors and Insulators (page 100)
5	5.3	What's the Source? (page 103)
6	5.2	Conductors and Insulators (page 100)
7 a)	5.1	Controlling Electric Energy (page 94)
7 b)	5.2	Conductors and Insulators (page 100)
7 c)	5.1	Open and Closed Circuits (page 93)
7 d)	5.1	Electricity on the Move (page 90) and Controlling Electric Energy (page 94)
8	5.1	Controlling Electric Energy (page 94)
9	5.1	Drawing Circuits (page 95)
10	5.3	Changing Electric Energy (page 102)
11 a), b)	5.1	What's the Source? (page 103)
11 c)	5.3	Changing Electric Energy (page 102)

Chapter 5 Review Answers (pages 104–105)

1. b) load

2. f) switch

3. d) electrocution

4. c) conductor

5. a) battery

6. e) insulator

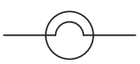
7. a) F. (A battery is an example of a source). Students may say:
- The three parts of a working electric circuit are the source, the load, and the conductor.
- The four parts of a working electric circuit are the source, the load, the conductor, and the switch.

b) T

c) T

d) F. The basic purpose of an electric circuit is to control electric energy and to change it into other kinds of useful energy.

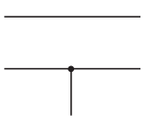
8. a)



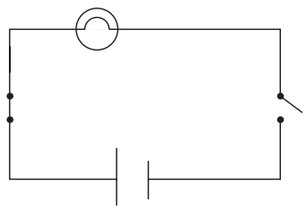
b)

c)

d)



9.



10. Answers will vary for a) and b). For example:

a) flashlight, reading light, LED display in computer, overhead light, Christmas lights, lights on stove and microwaves, lights on DVD or other electronic appliances

b) stove, oven, iron, baseboard heater, toaster, clothes dryer, hair dryer

11. a) city power grid (**Note:** This question does not reflect this chapter's focus on batteries as the source of power.)

b) the bell (**Note:** A more detailed answer would include the ringer as part of a coil assembly.)

c) electric energy to sound energy (**Note:** A more detailed answer includes that the ringer moves and the conversion includes motion. Some students may not have seen this while it may be obvious to others.)

Summative Assessment

- Have students complete **BLM 5–8 Chapter 5 Test** to assess individual skills.
- You may wish to develop **Master 3 Certificate** to show students what they have learned during this chapter. Cut and paste the related skills from **Master 4 List of Skills**.