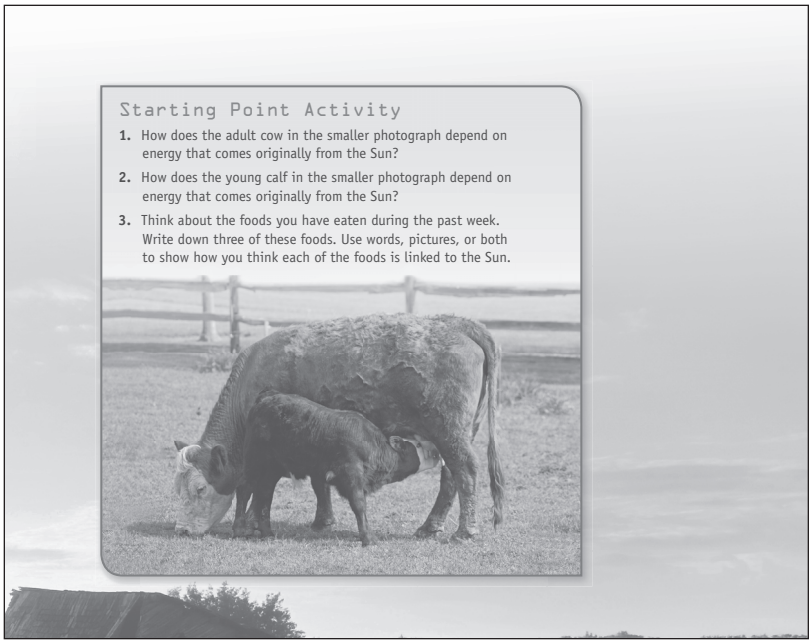
Overview of the *Science Links 9* Instructional Design

Science Links 9 has been developed to help you address the big ideas of the Ontario curriculum while meeting all of the specific expectations. Each unit of *Science Links 9* corresponds to a strand of Ontario's Grade 9 Science curriculum. Specific expectations related to Scientific Investigation Skills and Career Exploration are addressed in every unit. The Student textbook and Teacher's Resource together provide the tools and strategies you and your students will need for success.



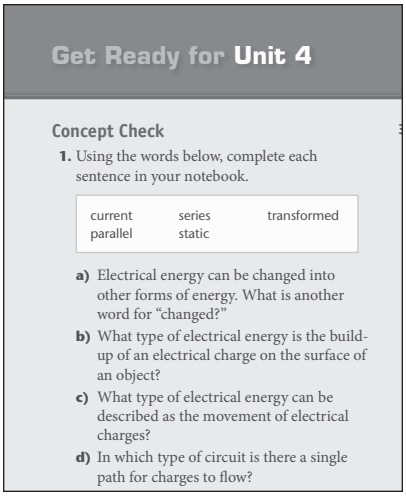
Engaging Students

To prepare students for what they will learn, each unit of the student textbook begins with an introduction to an engaging STSE issue, a preview of the topics in the unit, and the big ideas for the strand. Suggestions for using this material, and all other features of the student textbook, are provided in the Teacher's Resource.

Within a unit, each inquiry based topic begins with a description of the key concepts that students will learn about, an engaging example of one of the big ideas, and an activity to get students thinking and wondering about the concepts they will learn in the topic.

Assessment FOR Learning and Assessment AS Learning

Each unit begins with Get Ready—a chance to check that students have the science understandings, and the inquiry, literacy, and numeracy skills that they will require to succeed in the unit. In the Teacher's Resource, suggestions are provided for supporting learners who do not have these understandings and skills.



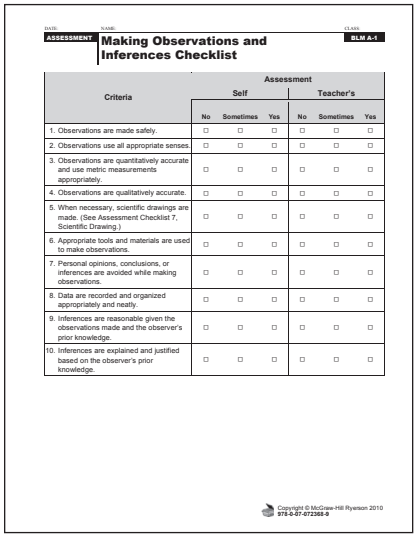
Each section of *Science Links 9* includes Learning Checks—short sets of questions that students can learn to use themselves to see if they are understanding the key ideas of the topic. Strategies are provided in the Teacher's Resource to help students use Learning Check questions, as well as to help support students who have not yet understood the key concepts in the text.

Each topic of *Science Links 9* ends with a summary and a review. These reviews can help you see whether students are ready to move onto the next section or chapter, and can help students see what they still need to work on. Questions are linked to Ontario's achievement chart categories. The optional blackline master CD includes alternative versions of these reviews, suitable for students who need additional support reading and writing in English.

The Teacher's Resource includes suggestions for supporting learners who are still working toward success in demonstrating understanding in these formative assessments. It also includes additional strategies to help students think about their own learning, enabling them to become self-directed learners.

Assessment FOR Learning		
Tool	**Evidence of Student Understanding**	**Supporting Learners**
Learning Check questions, student textbook page 247	Students list similarities and differences in generating electricity from moving water, burning fossil fuels, and nuclear reactions.	• Have students use a Venn diagram to compare two methods at a time. • Have students complete **BLM 4-5 Comparing Methods of Generating Electricity.**
Activity 4.2	Students list advantages and disadvantages of renewable and nonrenewable energy sources.	• The groupwork inherent in this activity should support students who require assistance. Establish homogenous groupings. • Make the group responsible for ensuring that each student is prepared to explain the group's process and results.
Investigation 4A	Students interpret and analyze information on a Website to draw conclusions about renewable energy sources.	• Ensure students understand what is meant by the term "green", and the nature of ecological endorsements.

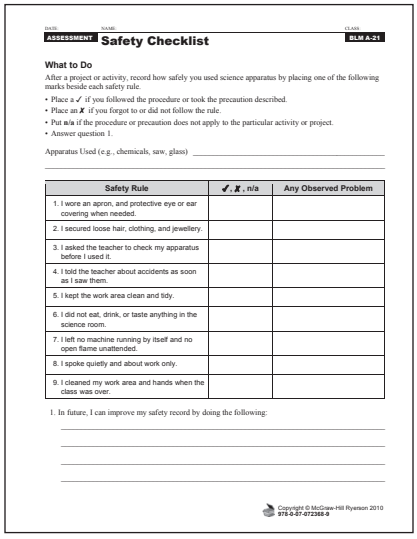
Science Links 9 includes several blackline masters to help support formative assessment and to guide students in learning to assess themselves. Please see the accompanying CD.



DATE: NAME: CLASS:

ASSESSMENT **Making Observations and Inferences Checklist** BLM A-1

Criteria	Assessment					
	Self			Teacher's		
	No	Sometimes	Yes	No	Sometimes	Yes
1. Observations are made safely.	☐	☐	☐	☐	☐	☐
2. Observations use all appropriate senses.	☐	☐	☐	☐	☐	☐
3. Observations are quantitatively accurate and use metric measurements appropriately.	☐	☐	☐	☐	☐	☐
4. Observations are qualitatively accurate.	☐	☐	☐	☐	☐	☐
5. When necessary, scientific drawings are made. (See Assessment Checklist 7, Scientific Drawing.)	☐	☐	☐	☐	☐	☐
6. Appropriate tools and materials are used to make observations.	☐	☐	☐	☐	☐	☐
7. Personal opinions, conclusions, or inferences are avoided while making observations.	☐	☐	☐	☐	☐	☐
8. Data are recorded and organized appropriately and neatly.	☐	☐	☐	☐	☐	☐
9. Inferences are reasonable given the observations made and the observer's prior knowledge.	☐	☐	☐	☐	☐	☐
10. Inferences are explained and justified based on the observer's prior knowledge.	☐	☐	☐	☐	☐	☐



DATE: NAME: CLASS:

ASSESSMENT **Safety Checklist** BLM A-21

What to Do

After a project or activity, record how safely you used science apparatus by placing one of the following marks beside each safety rule.

- Place a ✓ if you followed the procedure or took the precaution described.
- Place an ✗ if you forgot to or did not follow the rule.
- Put **n/a** if the procedure or precaution does not apply to the particular activity or project.
- Answer question 1.

Apparatus Used (e.g., chemicals, saw, glass) _____

Safety Rule	✓, ✗, n/a	Any Observed Problem
1. I wore an apron, and protective eye or ear covering when needed.		
2. I secured loose hair, clothing, and jewellery.		
3. I asked the teacher to check my apparatus before I used it.		
4. I told the teacher about accidents as soon as I saw them.		
5. I kept the work area clean and tidy.		
6. I did not eat, drink, or taste anything in the science room.		
7. I left no machine running by itself and no open flame unattended.		
8. I spoke quietly and about work only.		
9. I cleaned my work area and hands when the class was over.		

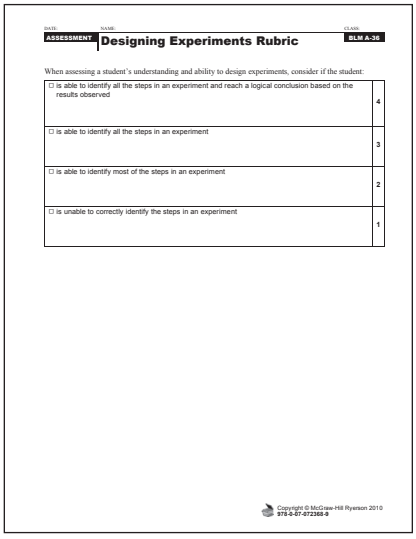
1. In future, I can improve my safety record by doing the following:

_____

_____

_____

_____



DATE: NAME: CLASS:

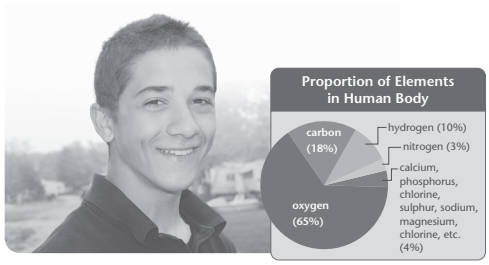
ASSESSMENT **Designing Experiments Rubric** BLM A-36

When assessing a student's understanding and ability to design experiments, consider if the student:

☐ is able to identify all the steps in an experiment and reach a logical conclusion based on the results observed	4
☐ is able to identify all the steps in an experiment	3
☐ is able to identify most of the steps in an experiment	2
☐ is unable to correctly identify the steps in an experiment	1

Developing Understanding

By introducing students to what they will learn at the beginning of each unit and by engaging them in a related activity as they begin, the stage is set for learning. Within each topic, text has been organized into self-contained spreads, each of which helps students acquire the understandings and skills they will need to answer the question in the topic title, and each of which has been designed to promote understanding. Heads and subheads lead students through the topic; Key Terms are introduced in context and defined; and information is presented in tables, graphs, and other visuals.



◂ **Figure 2.1** Elements are a certain kind of chemical that you will learn about starting in Topic 2.3. This pie graph shows the most abundant elements that make up the human body. The size of the pie wedges represents the proportion of the body that is made up of that element or elements.

Matter: The "Stuff" of the Universe

People commonly refer to many items in their daily life as "chemicals." But what is a chemical? You might think that it means something very specific to a scientist. After all, scientists are very careful about the ways that they define and use terms and ideas. However, the word "chemical" does not have a specific scientific meaning. That's because everything in the world that isn't energy is a chemical or contains chemicals. For example, do you think of yourself as being chemical-free? Think again. **Figure 2.1** shows that you are made up mostly of four chemicals of a certain type, with smaller amounts of many, many others.

When people use the word "chemical," they are really talking about matter. Anything—any *thing*—that has mass and that has volume (takes up space) is **matter**.

matter: anything that has mass and volume

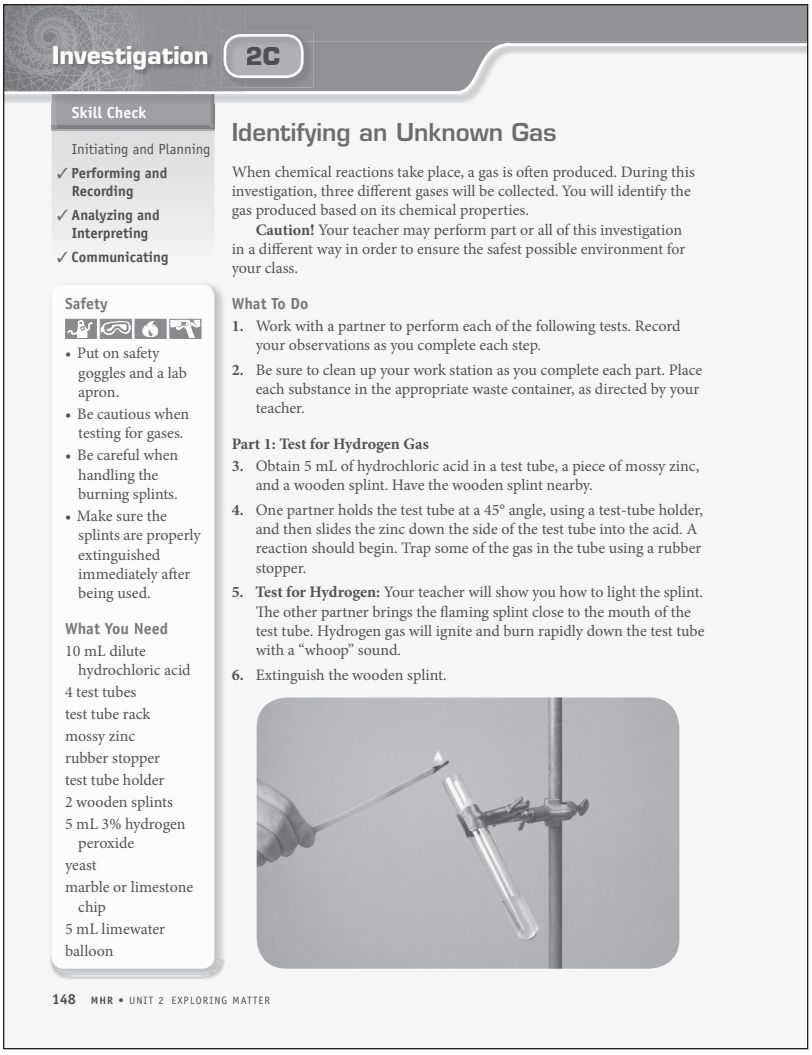
The authors of *Science Links 9* recognize that students employ multiple intelligences to understand new content. They also recognize that it is important for students to develop comfort with using several learning intelligences in different contexts. The text, questions, and activities in *Science Links 9* have been developed to engage as many intelligences as possible. In the Teacher's Resource, suggestions are provided for differentiating instruction to support students with specific dominant intelligences, and to develop increased facility with learning in different ways. Many of these suggestions are highlighted for you with the icon DI. For further information on differentiating instruction, please see Teacher's Resource page TR-12.

Many students in Ontario schools are learning to communicate in the English language at the same time as they are learning science. The many visuals in *Science Links 9* will help English language learners to make sense of the text, the Key Term definitions will help them to develop English vocabulary, and the hands-on activities will provide them with a way to learn and to demonstrate what they have learned that does not depend heavily on English skills. The Teacher's Resource provides specific suggestions for supporting English language learners as they learn in every section of the program. These suggestions are highlighted with the icon ELL. For general teaching strategies that will help English language learners (as well as others) in your classroom, please see Teacher's Resource page TR-18.

Developing Skills

At the very beginning of the student textbook, students are reminded of safe practices in a science classroom, and introduced to the WHMIS symbols and the safety symbols used in activities in *Science Links 9*. By placing safety front and centre, all other activities take place in the context of these rules. Strategies for using these pages with students are provided on Teacher's Resource page TR-10.

Activities throughout *Science Links 9* have been carefully scaffolded to build a solid foundation of science, inquiry, literacy, and numeracy skills. Investigations provide opportunities for students to apply the skills they have been developing to investigate a larger issue. The key skills students will use in each investigation are identified right in the student textbook. Opportunities for extending these skills are also provided in each investigation. Strategies for helping students to develop and build on these skills are provided in the Teacher's Resource.



Investigation 2C

Skill Check

Initiating and Planning
✓ Performing and Recording
✓ Analyzing and Interpreting
✓ Communicating

Safety

- Put on safety goggles and a lab apron.
- Be cautious when testing for gases.
- Be careful when handling the burning splints.
- Make sure the splints are properly extinguished immediately after being used.

What You Need

10 mL dilute hydrochloric acid
4 test tubes
test tube rack
mossy zinc
rubber stopper
test tube holder
2 wooden splints
5 mL 3% hydrogen peroxide
yeast
marble or limestone chip
5 mL limewater
balloon

Identifying an Unknown Gas

When chemical reactions take place, a gas is often produced. During this investigation, three different gases will be collected. You will identify the gas produced based on its chemical properties.

Caution! Your teacher may perform part or all of this investigation in a different way in order to ensure the safest possible environment for your class.

What To Do

1. Work with a partner to perform each of the following tests. Record your observations as you complete each step.
2. Be sure to clean up your work station as you complete each part. Place each substance in the appropriate waste container, as directed by your teacher.

Part 1: Test for Hydrogen Gas

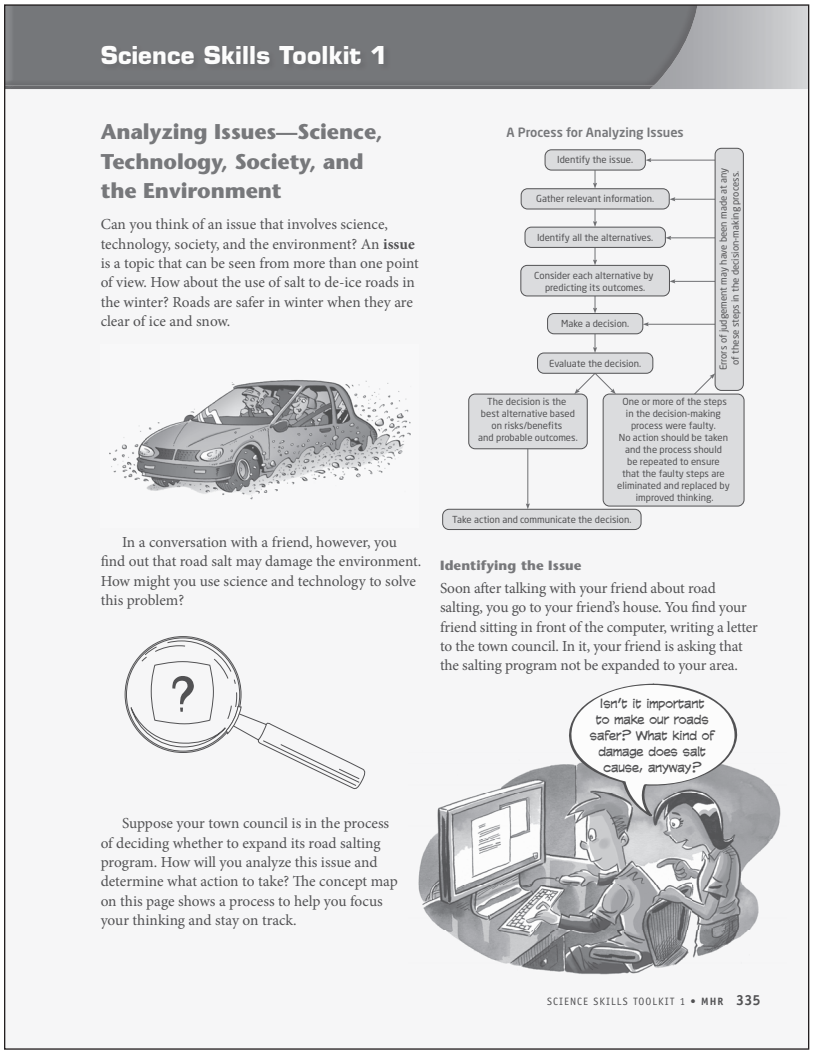
3. Obtain 5 mL of hydrochloric acid in a test tube, a piece of mossy zinc, and a wooden splint. Have the wooden splint nearby.
4. One partner holds the test tube at a 45° angle, using a test-tube holder, and then slides the zinc down the side of the test tube into the acid. A reaction should begin. Trap some of the gas in the tube using a rubber stopper.
5. **Test for Hydrogen:** Your teacher will show you how to light the splint. The other partner brings the flaming splint close to the mouth of the test tube. Hydrogen gas will ignite and burn rapidly down the test tube with a "whoop" sound.
6. Extinguish the wooden splint.

148 MHR • UNIT 2 EXPLORING MATTER

In addition to skills development in activities and investigations, students have access to three Skills Toolkits at the back of the student textbook:

- Science Skills Toolkit
- Numeracy Skills Toolkit
- Literacy Skills Toolkit

These toolkits can be used to provide students with details about the skills they will need to use, such as how to use electrical meters properly. They also can be used to review skills that students may have used in previous years. Notes in the Teacher's Resource suggest appropriate times to refer to one of these toolkits. The Teacher's Resource includes instructional strategies for helping students to make the most of each one of the Science Skills and Numeracy Skills in the toolkits. See page TR-68.



Science Skills Toolkit 1

Analyzing Issues—Science, Technology, Society, and the Environment

Can you think of an issue that involves science, technology, society, and the environment? An **issue** is a topic that can be seen from more than one point of view. How about the use of salt to de-ice roads in the winter? Roads are safer in winter when they are clear of ice and snow.

In a conversation with a friend, however, you find out that road salt may damage the environment. How might you use science and technology to solve this problem?

Suppose your town council is in the process of deciding whether to expand its road salting program. How will you analyze this issue and determine what action to take? The concept map on this page shows a process to help you focus your thinking and stay on track.

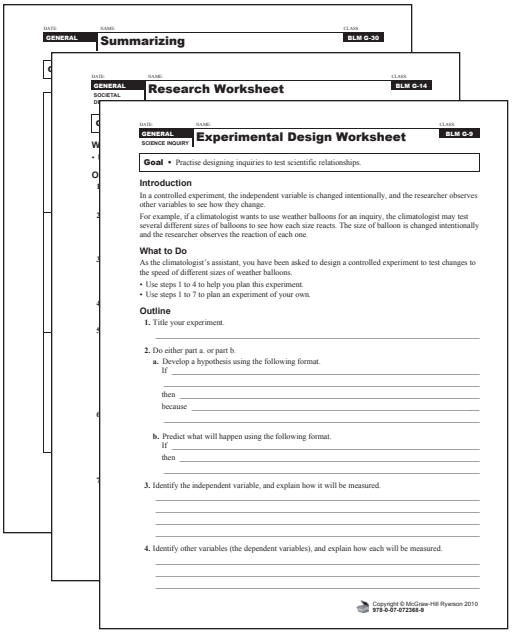
A Process for Analyzing Issues

Identifying the Issue

Soon after talking with your friend about road salting, you go to your friend's house. You find your friend sitting in front of the computer, writing a letter to the town council. In it, your friend is asking that the salting program not be expanded to your area.

SCIENCE SKILLS TOOLKIT 1 • MHR 335

Literacy skills are central to learning in any subject area, including science. A Literacy Skills Toolkit at the back of the student textbook reviews some key strategies for students to use in this program. Suggestions for introducing students to these skills and for using them as additional support for learners who require it appear throughout the Teacher's Resource. For more information about literacy skills and scientific literacy in general, see page TR-19 of this Teacher's Resource.



Science Links 9 includes several blackline masters to help students develop and apply science, numeracy, and literacy skills. See the accompanying CD.

Assessment OF Learning

Because authentic assessment is a core part of *Science Links 9*, each unit ends with two projects that students can use to show what they have learned. The activities and investigations within the unit prepare students to complete the projects. Assessment criteria are provided right in the student textbook so that students are aware of them. Rubrics for the projects are provided in the Teacher's Resource and as blackline masters. You may choose to distribute these rubrics, to help students plan their work. So that students are aware of the projects they will be completing as they work through the unit, the projects are introduced at the beginning of the unit, on the same pages as Get Ready.

Each Unit Review provides another opportunity for student assessment, and helps students show what they have learned in the unit as it relates to the big ideas of the curriculum, and the achievement chart categories: Knowledge and Understanding, Thinking and Investigation, Communication, and Application.

A table in the Teacher's Resource helps you identify the key signs that a student has achieved the overall expectations for the unit, and provides suggestions for supporting students who are working toward achieving them.

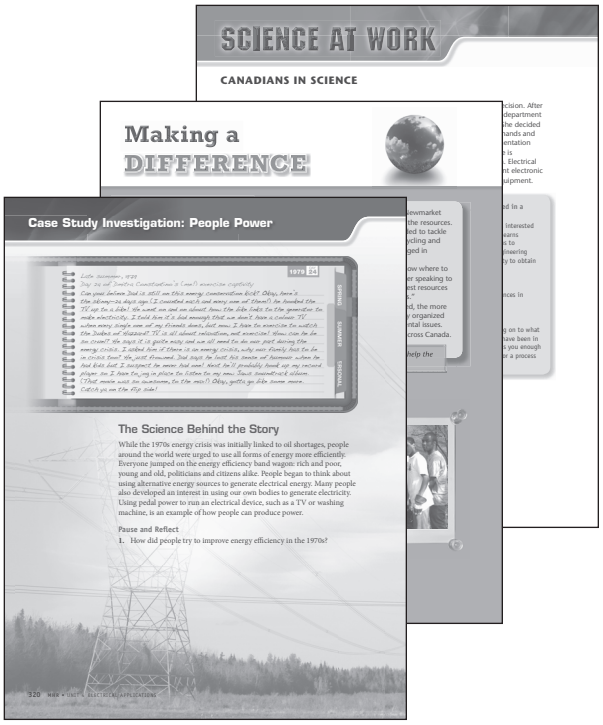
Assessment OF Learning for Unit 3

Activity	Evidence of Learning	Supporting Learners
Unit Inquiry Project, page 232	Students present an effective plan to purify a water sample, possibly through evaporation, straining, or bleaching. They record their results and answer questions 1 to 7.	Provide students with several possible purification options and have them select one to investigate. Examples and instructions can be found at **www.scienceontario.ca**.
Unit Issue Analysis Project, page 233	Students write a "to-do" list of what they need to research. They also provide a complete list of sources and research details. Their T-chart information details costs and benefits. Their final report clearly states their findings and recommendation.	Provide students with **BLM G-13 Citing Sources** to record their research sources. You may wish to provide **BLM G-15 Worksheet for Investigating Issues** to help them organize their results and recommendations.

Because students in Grade 9 are preparing for the Grade 10 Literacy Test, each unit also concludes with a relevant piece of text and a set of questions that students can use to practise their literacy skills in the context of a particular science strand.

Additional STSE Features

Students are growing up in a world where issues related to Science, Technology, Society, and the Environment are becoming more and more important. For this reason, STSE issues are integrated throughout the topics and activities of *Science Links 9*. In addition, *Science Links 9* includes the following features:



STSE Case Studies appear in every unit to help students see the connections among science, technology, society, and the environment, and to allow students to apply the science skills and understandings they are learning to real and compelling issues.

Making a Difference, in every unit, introduces students to real people who have used science to make a difference in their world, locally and internationally.

Science at Work, near the end of every unit, features real people in careers that use science to address issues. A variety of careers that use the science students have just learned about are described, and students are encouraged to select one that interests them and learn more about it.

The following pages provide additional information about some of the key issues that inform the instructional design of *Science Links 9*.