Topic 2.1
In what ways do chemicals affect your life?

Specific Expectations

- **C1** analyze how properties of common elements and/or simple compounds affect their use, and assess the social and environmental impact associated with their production or use
- **C1.1** analyze how the chemical and physical properties of common elements and/or simple compounds affect the use of everyday materials that contain those elements and/or compounds
- **C2.4** investigate and distinguish between the physical and chemical properties of household substances
- **C3.7** identify the elements and compounds in common household products

Skills

- make predictions or hypotheses based on research
- understand and follow safe laboratory procedures
- analyze data for reliability and bias
- make and justify conclusions
- communicate using appropriate language and a variety of formats

Materials

Please see the teaching notes for each activity for a list of the materials required. Please see pages TR-32 to TR-36 for a summary of the materials required in this topic.

Overview

In this topic, students will understand that everything is made up of chemicals and that substances have characteristics that make them useful, hazardous, or both. They will also learn how to handle chemicals and lab equipment safely and responsibly.

Common Misconceptions

- **Students may assume that plastic is the best material for containers because it is the most commonly used material.** Have students list the advantages and disadvantages of plastic when discussing the types of material used for containers. For example, glass containers are the most sturdy and reusable while plastic is lighter and recyclable. Metal tends to leach into acidic fluids; plastic can also do this. Students could use a chart to organize their thinking. Remind students to consider the purpose of the containers. Drink containers need to be portable and plastic is the lightest material. It is also the cheapest to manufacture. The total cost of single use plastic bottles compared to reusable glass or metal containers might not be obvious to students. Ask them which would require more energy: making a plastic bottle into another product or cleaning and reusing a glass or metal container.
- **Students might be confused by conflicting news stories about the benefits or risks of certain chemicals, such as aspirin or BPA.** Point out that news stories are summaries of very complex scientific studies and that the methods used to gather the data are often not mentioned. Two scientific studies that seem to contradict each other might be examining different aspects of the same substance, such as different conditions of use. Remind students that our knowledge of the chemicals around us is always changing. Suggest that students use the Internet to research a topic they find confusing to see the amount and variety of information that is available on the topic.
- **Some students will struggle with the idea that everything is made of chemicals.** They may think chemicals are only found in cleaning products or in science laboratories. Differentiate between matter and energy early in the topic to help them understand that if something is matter, it must be made of chemicals.
- **Students might have a false sense of security about the safety of products labelled "pure", "100% natural", or "chemical free".** Have students look at the periodic table in the unit opener and point to elements that are radioactive. Ask students if they think these elements are safe because they are pure and natural. Remind students to read product labels carefully to see the claims the companies are actually making about their products. Many will have disclaimers or safety warnings in small print. Students will examine the claim "chemical free" in Activity 2.1.

Background Knowledge

Plastic is the general common term for a wide range of synthetic polymers. A polymer is a large molecule composed of repeating smaller molecules. Polymers can break apart into their smaller subunits when exposed to extreme heat, UV light, or chemicals.

PET (polyethylene terephalate) is resistant to carbon dioxide and acid and is the popular choice for soda and juice bottles, since carbonation tends to attack other plastics. PET is also strong, durable, degrades slowly, and is abrasion resistant. Due to their insolubility in water and relative chemical inertness, pure plastics generally have low toxicity in their finished state and will pass through the digestive system with no ill effects. PVC (polyvinyl chloride, another type of plastic) on the other hand is a known human carcinogen.

We are still learning about the toxicity of the plastics we use. The primary building block of polycarbonate plastic, bisphenol A (BPA), is now recognized as an estrogen-like hormone disrupter that may leach into food. Some studies suggest that BPA can cause obesity, insulin resistance, and heart disease. It is also thought that BPA might be reducing the fertility of males of several species, including polar bears and humans. The Canadian government is currently planning regulations that will limit the amount of BPA released into the environment to limit human exposure to the chemical and has posted cautions about using baby bottles that contain BPA. See **www.scienceontario.ca** for more information.

Manufacturing and disposing of plastic produces toxic fumes and chemical pollutants. Although it can be recycled, the purity and quality of the plastic degrades each time it is made into a new product.

Each type of plastic has a different recycling code:

1. PET (*PETE*): Commonly found on 2-L soft drink bottles, water bottles, and peanut butter jars.
2. HDPE: Commonly found on detergent bottles and milk jugs.
3. PVC: Commonly found on plastic pipes, outdoor furniture, and shower curtains.
4. LDPE: Commonly found on produce bags, trash can liners, and food storage containers.
5. PP: Commonly found on bottle caps, drinking straws, yogurt containers, and some plastic toys, such as Lego®.
6. PS: Commonly found on foam packaging, cups, plastic tableware, and meat trays.
7. OTHER: Tupperware and Nalgene bottles.

Research has been done on biodegradable plastics that break down with exposure to sunlight (UV radiation), water or dampness, bacteria, or enzymes. Starch powder has been mixed with plastic as a filler to allow it to degrade more easily but the plastic still does not decompose completely. Some researchers have genetically engineered bacteria that synthesize a completely biodegradable plastic but this material is expensive at present.

Literacy Strategies

Before Reading

- Have students scan the headings in the topic and predict what they might learn. Then ask them to look at the diagrams and photographs. How do the images support students' predictions? After scanning the diagrams and photographs, would students like to revise their predictions?
- ELL English language learners may need more support understanding the use of sub-headings, stylistic features, or some of the vocabulary. For example, they may not understand that the dashes in the title on page 96 mean the writer is adding additional information or they might not understand the use of the term "stuff" on page 97. Support students by modelling how to scan the text. Talk about text features that can help them predict the meaning of the text. Model what good readers do by talking aloud about the punctuation and vocabulary that might trip up students.

During Reading:

- Have students write the subtopics as questions at the top of a page, and take notes about the details under each question as they read.
- ELL Model the note taking process for English language learners. Start with the first subtopic and show how to turn it into a question. Model strategies like going to the last sentence for the summary statement or focusing on the nouns and verbs.
- ELL Encourage English language learners to look up any words they do not understand in the glossary or a dictionary or determine whether there is a first language cognate that might help them understand. Explain that they do not need to know the full names of the plastics, just the initials.

After Reading:

- Have students use their notes to summarize each subtopic in 20 words or less.
- ELL Some English language learners would benefit from completing a cloze passage that models a good summary and requires them to focus on the key concepts rather than getting caught up in grammatical structures that they are still learning. Some students may benefit from writing a group summary where there is rich discussion about what information is important and not important for a summary.

Assessment FOR Learning

Tool	Evidence of Student Understanding	Supporting Learners
Activity 2.1, page 96 Learning Check, page 97	Students define "chemical" and explain that all matter, including themselves, is made up of chemicals.	• Students may think that all chemicals are harmful. Work with students to create a list of chemicals that we need in order to survive (oxygen, water, sugar, and so on). Then point out where these chemicals are found. Challenge students to name something made of matter that does not contain chemicals, and invite other students to explain why they disagree.
Activity 2.2, page 98 Learning Check, page 99	Students explain the beneficial and hazardous characteristics and uses of common substances.	• Supply students with material safety data sheets (MSDS) for the substances in the activity to aid their research. • ELL English language learners may benefit from seeing photos of the substances. • Have students brainstorm a general list of beneficial and hazardous characteristics that substances might have before examining specific substances.
Activity 2.3, page 101 Learning Check, page 101	Students identify safety and WHMIS and explain and follow laboratory safety practices and procedures.	• Supply students with **BLM G-3 WHMIS Symbols Cards,** to trace or cut out and tape in their notebooks when answering question 2 in Activity 2.3. • Supply students with a classroom map to label for Learning Check question 4.

Topic 2.1 (Student textbook pages 94–103)

Using the Topic Opener

- Bring in a can, a glass bottle, and a plastic bottle. Have students list advantages and disadvantages of manufacturing, transporting, using, and disposing of each container. Then ask them to list questions they have about the properties of each material. Students might be curious about which material really is safest for food or which material requires more energy to create or dispose of. Point out that every material has characteristics that make it suitable for some uses and unsuitable for others.
- ELL English language learners are still acquiring vocabulary. Explain in student friendly terms words like *advantages* (pluses), *disadvantages* (minuses), *manufacturing*, and *characteristics*.

- Have students read page 94 with a classmate, and discuss the uses of recycled plastic shown on page 95. Pair students who need support reading with strong readers.
- As an extension, challenge students to learn to say the full name of PET (polyethylene terephthalate). The correct pronunciation is provided in the student textbook.

Starting Point Activity (Student textbook page 95)

Pedagogical Purpose

The purpose of this activity is to have students think critically about why different materials are used for specific purposes. It sets the stage for later thinking about why certain elements are used for different purposes and opens up discussion about the hazards, benefits, and consequences of using chemicals to increase quality of life.

Planning	
Materials	Examples of different plastics (containers, plastic tableware, scouring pads, netting), metal and glass containers
Time	10 min
Safety	Warn students that metal containers can be sharp and that glass containers are breakable. Clean up any broken glass immediately.

Activity Notes and Troubleshooting

- Some students, especially English language learners, may not be familiar with all the materials in the photographs. Ask volunteers to identify and explain the use of each item. Plastic kayaks are lightweight and durable. Veterinary cones are used to keep cats and dogs from licking an injury. Plastic netting is used to package nuts, small cheeses, and plastic toys.
- This activity would work best in groups or pairs but can be done independently. If students work independently, have them share their responses and ideas in a class discussion afterwards. As key ideas are discussed, write critical vocabulary on the board to provide the repetition that supports English language learners.
- Assign roles within each group to keep students focused and engaged. A group of four would have a reader, a secretary to record the answers, a time keeper to keep the activity moving, and a handler to collect and distribute the objects. Some English language learners may be more comfortable with the last two roles. Ensure that they understand the task.
- Display all the objects at the front of the room. Then have the handler in each group take a few items. Once each group has examined the items have them pass the items to a group beside them instead of returning the items to the front of the class. Ensure that students have a chance to examine all the objects.
- Encourage students to look for patterns in the materials and then formulate and test their hypotheses about plastics based on their observations. Students could use a T-chart to organize their thinking when answering the questions.

Additional Support

- Enrichment—Ask students to brainstorm additional items they think are made of PET. Or they could check their school cafeteria or home for containers and list all the different types they find and their uses.
- Some students may be challenged to connect personally with the items. Ask if students have a personal story that they want to share about plastic.

- DI ELL Bodily-kinesthetic, spatial, and English language learners will benefit from handling the materials they are discussing. Encourage English language learners to name the materials in their first language if they are struggling to find the English word.
- Enrichment—For question 5, students could brainstorm ways to implement their suggestion to improve participation in municipal recycling programs. Or they could create a poster to educate people about the types of plastic can be recycled in their town or city. This activity enables English language learners to demonstrate their understanding without using a lot of language.

Answers

1. Plastic, steel, glass, and aluminum are suitable materials for drink containers because they do not dissolve in liquids like water and they can be moulded into different shapes.
2. Plastic drink containers have become more widely used because they are cheaper than glass and metal. They are also lighter and more durable. Glass containers are heavy and can break. Metals containers cannot be used for some liquids like acidic fruit juice because the metal will leach into the liquid.
3. Answers may vary. Use them for a new purpose, recycle them, throw them in the garbage.
4. Answers may vary. Students may be surprised that plastic bottles can be made into something as strong as a kayak.
5. Answers may vary. Some people do not recycle because they live in apartment buildings that do not have a recycling program. Others do not understand how to tell if an item is recyclable. Some municipalities only accept certain plastics for recycling but this is changing now. Some municipalities also have very strict rules about how recyclables are sorted. This makes it hard for some people to understand so they do not even try. If recycling were easier, more people would do it. Perhaps the items that can be recycled could all have the same logo on them.

Instructional Strategies for Topic 2.1

- Use a graffiti activity to introduce the topic.
  - On the chalkboard, write: "How do chemicals affect your life?" On separate sheets of chart paper, write the headings: Kitchen, Sports, Leisure/Hobbies, Technology, Work Place, Personal Care/Hygiene.
  - Place students in groups of four and give each group a different coloured marker. Explain that they will answer the question for each heading on the chart paper. Each time they move to a new station, the pen should be passed to a new student so everyone in the group has a chance to write an answer.
  - Give groups 1 to 2 min at each station. You might need to remind students to rotate the role of scribe by passing the pen. English language learners may need to pass on this role but give them the opportunity.
  - Once groups have rotated through all the stations and are back at their original station, have each group write one or two questions they have about how chemicals affect their lives for their given heading. Then choose one student from each group to report their best question and an interesting point on their chart paper.
  - Post the graffiti charts in the classroom for the duration of the unit. You can also record the questions posed by each group and use them as hooks to introduce subsequent lessons.

- Read each chunk of text aloud to the class or have students work in pairs and take turns reading to their partner. Students should make notes for each chunk.
- ELL Pair English language learners with students who have strong English reading skills.
- Have students look at Figure 2.1 on page 92. Ask them if they are surprised by the elements contained in the human body. (Chlorine, sulfur, and sodium are toxic in their natural state.) Are the proportions of the elements what they expected? If not, what element did they think would be the most common? Provide a synonym or an explanation of words such as "proportion" to help English language learners better understand the questions.
- Before reading the section "Matter: The "Stuff" of the Universe" on page 92, use a T-chart to compare matter and energy.
- Supply students with **BLM 2-4 Recycling Symbols**, for more information about recycling symbols and the types of products made from each material. They might find the blackline master useful when answering the Learning Check questions.
- Supply students with a classroom map for question 3 of the Learning Check on page 101. This will ensure that students can fit all the locations into their diagram. Divide the classroom into five or six areas and divide students into small groups. Have each group examine one area for 1 to 2 min, then rotate to the next area to keep students organized and focused while answering the question.
- ELL English language learners will benefit from using **BLM 2-6 Topic 2.1 Review (Alternative Format)**, which has simplified and clearer language. If they are using the Review in the student textbook, go over the vocabulary to make sure they understand the questions. For example, they may not understand the reference to "ways" in question 1 or what is meant by a concept map in question 6. Some students may not be able to fully answer each question; check that they have a basic understanding of each concept.
- Enrichment—Use the Internet to search for current issues about plastics, such as new information about toxic effects, bans on plastics, or new innovations. Post the articles for students to read. Initiate a class discussion about topics students find interesting.

Activity 2.1 Chemical-Free (Oh Really?) (Student textbook page 96)

Pedagogical Purpose

This activity is designed to show students that everything is made of chemicals.

Planning	
Materials	Examples of household cleaning products, decaffeinated coffee tins, and anti-bacterial cleaning cloths (optional)
Time	10 min

Skills Focus

- think critically
- explain and support reasoning
- respect opinions of peers

Activity Notes and Troubleshooting

- Students may not consider water or coffee to be chemicals because they are foods. Write the headings "Chemicals" and "Chemical free" on the chalkboard or chart paper. Ask students for examples of common substances they use at home and have them tell you which group each substance belongs in. Say the words aloud as you write them to support English language learners' language development. You will return to this list after students have completed the activity. Say the words aloud as you write them to support English language learners' language development. You could also write the substances on pieces of paper and tape them to the chalkboard or use an interactive whiteboard, if available.
- Have students complete a placemat activity in small groups as you read the three facts aloud. Students should write key words they think will be important in defining "chemical free". Then have the groups share their key words and come to a consensus about what "chemical free" means. Their shared definition should be written in the placemat centre.
- Before students move into groups, ask them for examples of things they can say to encourage others in the group to share ideas. Have them also give examples of ways they can show students who are speaking that they are listening and appreciate their input. List these ideas on the chalkboard and encourage students to use them.
- Prompt students to consider all the contents of each product and to look for similarities and differences. This will promote critical literacy skills by having students read beneath, behind, and beyond the information provided.
- To train students to support their reasoning, ask them to provide two facts to support each of their answers. This supports developing students' metacognition skills. Give English language learners an example of what you expect.
- Once the class has completed the activity, return to the list of substances. Ask students if they still agree with how they sorted the substances or if their opinions have changed. Ask students to give one or two facts about each substance to justify moving the substance or keeping it in its group. Students should understand that all the substances belong in the "Chemicals" group. If students argue that a substance should remain in the "Chemical free" group, compare it to similar substances they placed in the "Chemicals" group to help them understand that it is a chemical. This supports the sharing and clarifying of the learning goals. Some English language learners may not express their opinions because in some cultures it is considered inappropriate. Explain the language of argument (agree/disagree, justify).

Additional Support

- ELL If English language learners do not know the words for some common products, they can describe the products, or what they are used for, and you can provide the English word.
- Enrichment—Challenge students to list all the chemicals that they use in a 24 hour period.
- If students are having trouble thinking of household products, provide containers or labels from common household substances. Ask students to look for clues on the label that tell whether it is chemical free or not.

Activity 2.1 Answers

1. Answers may vary. Students may say chemical free means without additional chemicals that might cause harm.
2. No product can be chemical free because all matter is made of chemicals.
3. A chemical is a substance that is made of matter. A chemical is not made of energy.

Learning Check Answers (Student textbook page 97)

1. Matter is anything that has mass and volume.
2. Hydrogen is the element that is most abundant in my body.
3. Answers may vary. Products made of PET plastic (recycling code 1) include 2-L soft drink bottles, water bottles, and peanut butter jars.
4. People who do not understand that everything around us is a chemical might say that a health product or a fertilizer is chemical free when they mean that it is safe and non-toxic.

Activity 2.2: Considering Pros and Cons (Student textbook page 98)

Pedagogical Purpose

The purpose of this activity is to introduce students to the critical thinking that is a part of scientific research. Students should be encouraged to verify their information by finding it in more than one source and to be aware that some sources are not as trustworthy as others.

Planning	
Materials	Research material or Internet access Material data safety sheets (MSDS) for each chemical (optional)
Time	30 min

Skills Focus

- think critically
- analyze data
- use a graphic organizer

Activity Notes and Troubleshooting

- Encourage students to use encyclopedias, material safety data sheets (MSDS), library books, and other resources for their research. Most students will tend to prefer using only the Internet. Or you could provide reliable sites for students to use, explain why they are reliable (what to look for) and then challenge students to find another site of equal value.
- Students may need to be shown how to use Internet search engines or the school library resources.

- Have students refer to Science Skills Toolkit 8: How to Do a Research-Based Project on page 358 to assist them in deciding if a resource is reliable, biased, or accurate.
- If the library or computer lab is not available, supply material safety data sheets (MSDS) for each chemical and give this activity a literacy focus instead of a research focus.
- Ask students to look at the table provided in the activity. Deconstruct the table with them so they understand the purpose of each heading. Discuss what each heading means and rephrase the headings if required.

Additional Support

- Students might be interested in a certain chemical because a family member uses it at work or because of the sound of the word or its associations for them. Allow students to choose their chemical instead of assigning them. Students might also want to choose a chemical that is not on the list. Suggest that students choose chemicals that have different properties than ones on the list so the class can learn more about chemicals' uses and characteristics. Have students show you their research to check that it fits the criteria set out in the table before compiling the class data. You might need more time for compiling the data if many students choose additional chemicals.
- Some students may find the table hard to work with. Allow them to organize their research in a different format. For example, they may prefer to make notes with the column titles as subheadings.
- ELL Pair English language learners with students who have strong English skills. Pair students based on interest as well. Encourage them to use their table to talk about their chemical. For example, from the table, gold is used to make jewellery. It is hard, shiny, and does not tarnish. It is generally harmless but should not be stored with acids. These types of activities strengthen their understanding of the concepts and build language skill in an authentic context.
- Some students may require one on one assistance in finding appropriate resources.
- Students could present their research in an alternative format such as a poster, a song, a poem, or a role-play. For example, they could make an advertisement for their chemical, showing its characteristics and uses. Or they could create a wanted poster for their chemical, basing the chemical's "crime" and description on their research. Give English language learners time for rehearsal before asking them to present in front of the class.

Activity 2.2 Answers

1.

Substance	Common (or main) Uses	Useful Characteristics	Hazardous Characteristics	Special Storage and/or Disposal Requirements
gold	jewellery	hard, shiny, does not tarnish	generally harmless	• do not store with acids
iron	construction , manufacturing	cheap, strong	may cause organ damage if swallowed or inhaled	• keep away from oxygen and acids
mercury	thermometers	reacts quickly to changes in temperature	corrosive	• keep in a cool, dry, well-ventilated area • keep away from metals send to hazardous waste site
propane	fuel for barbecues	burns easily	explosive	• do no store near flame, sparks, or hot surfaces • return cylinder to supplier
caustic soda (sodium hydroxide)	paper making	bleaches paper and cloth	corrosive, toxic	• keep container tightly closed • send to hazardous waste site
muriatic acid (hydrochloric acid)	removes rust from steel	strong acid	corrosive	• keep away from heat or flames • send to hazardous waste site
sulfuric acid	used in production of phosphate fertilizers	strong acid	corrosive	• keep away from combustible materials and water • do not store near alkaline substances • send to hazardous waste site
acetone	thins fibreglass resin	good solvent for plastic	will burn skin and eyes, flammable	• keep away from direct sunlight and heat
lead	batteries	does not corrode	poisonous	• keep in a cool, dry, well-ventilated area • recycle or send to hazardous waste site
methanol	used in antifreeze	lowers freezing point of water	toxic, flammable	• keep away from heat, sparks, and flames

Learning Check Answers (Student textbook page 99)

1. *Useful*: ammonia kills bacteria and germs.
Harmful: ammonia can burn the skin.

2. The hospital workers can put the bags of laundry into the washing machine because the PVA bags dissolve in water.

3. Answers may vary. A PVA plastic bag could be used for dirty diapers or for compost or animal waste.

Activity 2.3 Safety First (Student textbook page 101)

Pedagogical Purpose

This activity introduces students to proper laboratory safety procedures by having them identify the hazards in simple laboratory instructions.

Planning	
Materials	**BLM G-3 WHMIS Symbol Cards** **BLM 2-5 Activity 2.3** (optional)
Time	20 min

Skills Focus

- read and analyze data
- think critically
- visualize written instructions

Activity Notes and Troubleshooting

- Supply students with **BLM G-3 WHMIS Symbol Cards**. Suggest that they put a check mark beside each symbol when they draw it to keep track of the symbols they have not used yet. Note that only a few of the WHMIS apply to the instructions.
- Supply students with **BLM 2-5 Activity 2.3**. Have students highlight key words as they read and use the key words to identify the symbols that apply. Students can also use the key words to search the "Safety in Your Science Classroom" section on page xii for comments that apply to each instruction. This can help them identify the appropriate symbols. If necessary, point out that many of the subheadings match the safety symbols.
- Instead of having students read the instructions, have pairs of students act out each instruction without using any equipment. This will help students visualize the equipment and materials used and identify the potential hazards. Make sure that English language learners understand the task and give them time to rehearse. Some students may shy away from this type of activity because it is not valued in their country of origin.
- Once students have completed the activity, write the letters A to G on the chalkboard and have students tell you which symbols they think apply to each instruction. Ask students to justify their choice of symbol by referring to one or two facts in the instruction.

Additional Support

- Supply students who are not comfortable drawing with tracing paper so they can trace the symbols from their textbooks or from **BLM G-3 WHMIS Symbol Cards**. Or they can cut up several copies of the blackline master and tape the appropriate symbols into their notebooks.
- ELL Supply English language learners and tactile learners with pictures of the laboratory equipment mentioned in the instructions. Have them arrange the pictures to match each instruction to help them visualize the potential hazards.
- Ask volunteers to act out each instruction with equipment for students who need support understanding what is being described.

Activity 2.3 Answers

2. A. Thermal Safety, Eye Safety, Electrical Safety

B. Thermal Safety, Eye Safety, Electrical Safety or Fire Safety and Flammable and Combustible Material depending on how sugar is being heated

C. Thermal Safety, Eye Safety, Fire Safety, Flammable and Combustible Material

D. Disposal Alert, Sharp Object Safety, Thermal Safety

E. Fume Safety, Thermal Safety, Eye Safety, Clothing Protection Safety, Fire Safety, Flammable and Combustible Material

F. Clothing Protection Safety, Skin Protection Safety, Eye Safety, Chemical Safety, Corrosive Material, Dangerously Reactive Material

G. Clothing Protection Safety, Skin Protection Safety, Eye Safety, Chemical Safety

Learning Check Answers (Student textbook page 101)

1. The safety icons and WHMIS communicate important information about chemicals, equipment, and procedures in an experiment.

2. Clothing Protection Safety, Eye Safety, and Skin Protection Safety could be used for any experiment because you should always wear protective clothing when performing an experiment.

3. Answers may vary.

A. Caution! Do not leave the hot plate unattended.

B. Caution! Watch the sugar carefully. It can get very hot and boil over.

C. Caution! Point the open end of the test tube away from yourself and others.

D. Caution! Handle the pin carefully. It is sharp.

E. Caution! Use a fume hood to remove the ammonia gas.

F. Caution! Wear safety goggles, gloves, and an apron when handling acids and bases.

G. Caution! Wear safety goggles, gloves, and an apron when handling the substance.

4. Answers will vary. Check that locations are correct.

5. Answers will vary. Check that rules are correct.

Using Strange Tales (Student textbook page 102)

Literacy Support

Before reading

- Have students look at the images and predict what the text is about. Ask them to suggest how the title "Minding Scientific Inquiry" relates to the images. Be aware that English language learners who have left their country of origin due to war might find these images and the ensuing discussion unsettling. Modify how you teach this section accordingly.

During reading

- The text is brief. Students may find it amusing to read it aloud together in their best scary villain voice.

After reading

- Challenge students to write a headline that summarizes the text.

Instructional Strategies

- Ask students to tell you about any famous scientists they know about. Then tell them a little about the philosopher and mathematician René Descartes. He was born in France in 1596 and died in Sweden (not Denmark) in 1650. He coined the phrase "I think, therefore I am," to explain his scientific method of doubting all knowledge and then using first principals and a series of deductions to reach a conclusion. He was the first mathematician to make a graph and invented the Cartesian coordinate system. His methods and theories were very influential until they were replaced by Newton's methods.
- Ask students if they have heard other stories about bodies being dug up and moved after they were buried. Do they know why this was done?

- ELL English language learners might be confused by the "Bwahahahahah" in the first paragraph. Have a student describe what kind of laugh this is and how other laughs might be written. Ask English language learners for examples of how laughter can be written in their native language.
- To further support literacy, have students continue the story by answering the question: "What happened next ... ." Students could use a creative format such as a play, a poem, a song, or a picture.

Strange Tales Answers

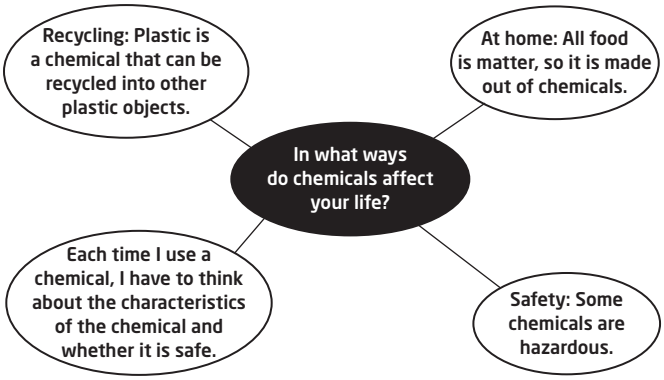
1. Yes. Descartes body was taken to France and buried in a churchyard in Paris.
2. Answers may vary. Descartes said you should start an inquiry by doubting everything so you do not have any preconceived ideas that could bias your thinking. He also said that you should end an inquiry by organizing your data into lists so you have a clear understanding of what you have discovered. Avoiding bias in your thinking and organizing your data are two concepts that are used in modern scientific inquiry.
3. Answers may vary. Students' answers could include planning an experiment to test a hypothesis, avoiding bias in data collection, or organizing data.

Topic 2.1 Review (Student textbook page 103)

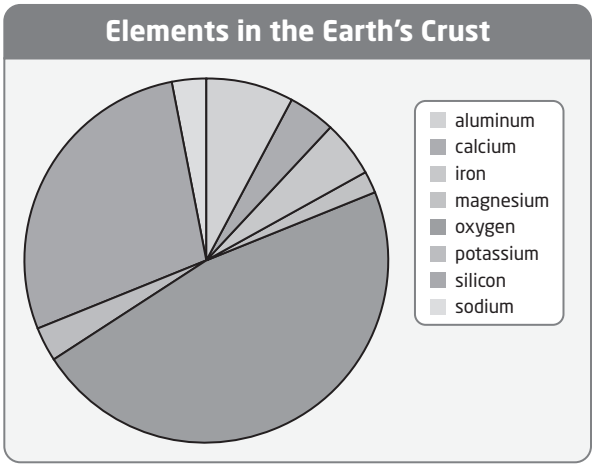
Please see also **BLM 2-6 Topic 2.1 Review Answers (Alternative Format)**.

Answers

1. Graphic organizers may vary.



2.



3. Matter is made of particles and takes up space. It is anything that is not energy.

4. Answer may vary.

a) grocery bags, trash can liners, dry cleaner bags, and resealable baggies

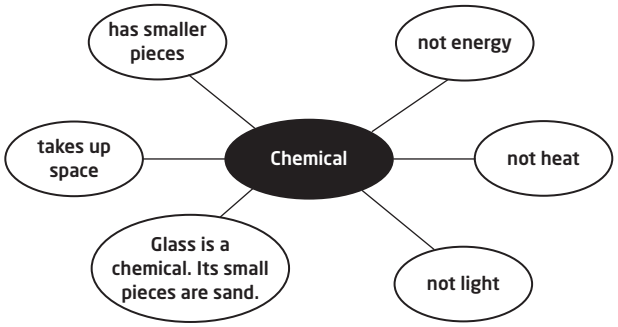
b) grocery bags, dry cleaner bags

c) I would have to remember to bring a cloth bag if I go shopping. My lunch bag would be heavier because the containers would be glass or metal.

d) Everything I use would be made out of wood, metal, glass, or cloth so it would be heavier and bulkier. I would clean and reuse items instead of throwing them away.

5. Answers may vary. These products can get into the water supply and contaminate lakes and streams, killing fish or causing algae blooms.

6. Concept maps may vary.



7. Banning Bottled Water

Pros	Cons
• plastic water bottles can contain chemicals that are harmful	• athletes need to drink liquids or they can get sick
• athletes can bring their own containers which have their names on them	• arenas make less money
• recycling plastic is expensive	
• the quality of the plastic gets worse each time it is recycled	

Some arenas have banned the sale of bottled water. This is better for our environment because fewer water bottles will have to be recycled. It is also better for our health as the bottles can contain harmful chemicals. But if athletes forget their water bottles, they could get dehydrated and very ill. Arenas will also make less money because people will bring their own containers and refill them for free. I think arenas should warn people that they will be banning the sale of water so people get used to bringing their own bottles.