Topic 2.6
What are some characteristics and consequences of chemical reactions?

Specific Expectations

- **C1.2** assess the social and environmental impact of the production or use of a common element or simple compound
- **C2.2** use an inquiry process to identify the physical and chemical properties of common elements and simple common compounds, including gaseous substances
- **C2.7** conduct chemical tests to identify common gases on the basis of their chemical properties, and record their observations

Skills

- make predictions or hypotheses based on research
- understand and follow safe laboratory procedures
- conduct inquiries
- analyze data
- 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 page TR-42 for a summary of the materials required in this topic.

Overview

In this topic, students will explore the chemical changes that convert elements into compounds and compounds into elements. They will also analyze the safety issues surrounding some of the chemical reactions they encounter in their daily lives.

Common Misconceptions

- **Students may think that the only place they are exposed to dangerous chemicals or chemical reactions is in the lab at school.** Many students do not realize the hazards associated with common household cleaners. Stress the importance of reading the labels of all the chemicals they handle and looking for the Household Hazardous Product Symbols to learn how to use the chemicals safely.
- **Students have difficulty understanding when a colour change is a chemical change and when it is a physical change.** Show examples and non-examples of colour changes that are chemical changes. For example, if a red chemical is mixed with a white chemical and turns blue, it is a chemical change. If a red chemical is mixed with a blue chemical and the solution turns purple, it is simply a physical change. Remind students that a chemical change will produce a new colour that cannot be the result of the two original colours being mixed together.

Background Knowledge

The photo of burning coals in the unit opener shows a combustion reaction. Combustion occurs when a hydrocarbon fuel reacts with oxygen in the presence of heat. The products of complete combustion are water vapour and carbon dioxide gas. Incomplete combustion produces carbon monoxide, which causes air pollution. If the fuel is not pure, it produces gases such as sulfur dioxide or nitrogen dioxide, which cause acid rain.

The photo of the bubbling beaker is a neutralization reaction. This occurs when an acid reacts with a base to form a salt and water. The best way to clean up a spill of an acid (like vinegar) is to sprinkle some base (like baking soda) on the spill until it stops bubbling. The same concept could be applied to cleaning up a base spill by adding acid to the spill.

Chemical reactions are the only way to make the multitude of chemicals we use in our daily lives from the limited number of elements in the periodic table. Any time an element is combined to make a compound, a synthesis reaction has occurred. The conversion of a compound (like water) into its component elements is a decomposition reaction.

Along with the desired products of a chemical reaction there are usually unwanted by-products. It is these by-products that are generally harmful. For example, chlorine cleaning products can react with other cleaning products to produce chlorine gas, which is toxic. Many alternative products are now available that are safer and more environmentally friendly, and work just as well as the more toxic products. Students should be challenged to compare these products as potential consumers and to ask themselves if stronger is always better.

Literacy Strategies

Before Reading

- Point out the key term *chemical reaction*. Based on what students know about chemical and physical properties, have them predict what a chemical reaction might be.
- Have students scan the pictures in the topic and discuss types of reactions they have seen or experienced.
- Ask students to describe alternative cleaning products they are familiar with.
- ELL This is one of the most important phases of the learning cycle for English language learners. Some students may have had first hand experiences with chemical reactions but do not have the vocabulary to express what they know. Other English language learners may have had little experience with the chemical reactions mentioned in the text, such as fireworks or the production of fertilizer. Define each chemical reaction in simple terms, describing a first hand experience if possible. Take them to the visuals. Write key vocabulary on the chalkboard as you discuss an example. Ask them to sketch and explain another example.

During Reading

- Invite students to share things they have been told about chemicals and their hazards.

After Reading

- ELL Ask students to explain why the alternative cleaners are considered safer but not harmless. Explain terms such as *safer* and *harmless* for English language learners.
- ELL Students could create an advertisement that compares a traditional cleaning product to an alternative product. Walk English language learners through an example before assigning this as an independent activity.

Assessment FOR Learning

Tool	Evidence of Student Understanding	Supporting Learners
Starting Point Activity, page 141	Students perform experiments to observe simple chemical reactions and record their observations.	• DI Spatial learners should be encouraged to make drawings of the set up, their predictions, and their observations. • Demonstrate the setup of each mini-activity to ensure that students know what to do. • Connect the experiments to real life to engage students.
Learning Check, page 143 Activity 2.12, page 143	Students analyze the benefits and consequences of common chemical reactions and identify desirable and undesirable products of reactions.	• Supply **BLM 2-31 Activity 2.12** to students who need help interpreting the photos. • Show videos of different chemical reactions. • ELL Pair English language learners with students with strong English language skills and allow them access to the Internet.
Learning Check, page 145 Activity 2.13, page 145	Students read product labels and use HHPS to determine the uses and dangers of products.	• DI ELL Use flash cards to help spatial and English language learners match the HHPS with their meanings. • Ask students to describe potential hazards and consequences of not following safety instructions. • Show videos that depict household accidents and discuss how the accidents could have been prevented or predicted.
Activity 2.14, page 147 Learning Check, page 147	Students compare traditional and alternative cleaning products.	• Use one product to model an effective test for students. • Provide a template to complete that directs students through this inquiry, listing volumes to use and times to wait.

Topic 2.6 (Student textbook pages 140–151)

Using the Topic Opener

- Have students brainstorm answers to the topic question by listing some reactions they are familiar with and their characteristics and consequences. For example; fire is a reaction that includes heat and smoke. The consequences of the reaction are the destruction of combustible matter, which could be good, as in a campfire, or bad, as in a house fire.
- List the clues students can use to decide if a chemical reaction is occurring: change in colour, release of gas, production of a precipitate, or release of energy.
- Demonstrate different reactions and ask students to explain how they know each demonstration is a chemical reaction. The water-wine-milk-beer demonstration is a classic. See **www.scienceontario.ca** for the set-up and an explanation of the experiment. You could also burn magnesium ribbon. Caution: Do not look at the ribbon while it burns.
- Engage students with dynamic demonstrations. Fill a balloon with hydrogen gas, light the string and you will get a huge pop when the string gets to the balloon and ignites the gas. Create beautiful colours using universal indicator and a variety of strengths of acid or base. Show students the spectacular side of chemistry.

Starting Point Activity (Student textbook page 141)

Pedagogical Purpose

The purpose of this activity is to have students complete some safe chemical reactions that have impressive outcomes and to practise making and recording observations about reactions.

Planning	
Materials	Per set of tests: 200 mL vinegar 4 small jars with lids (baby-food or small jam jars), steel wool stainless steel spoon 5 mL baking soda egg
Time	5 min
Safety	Wash hands after handling raw egg or if vinegar is spilled on skin.

Activity Notes and Troubleshooting

- Have students work in groups. Allow groups to choose the activities they would like to observe. To reduce the quantities of materials needed, consider having each group complete only one or two activities instead of all four.
- ELL Each group should predict the results they will get, observe their experiments daily and record their observations, and then explain their results to the class in a short presentation or gallery walk. Ensure that English language learners have had experience with these types of learning strategies. They may need additional explanation regarding the process and rehearsal time prior to presenting.
- Assign roles to group members that will rotate each day. Roles could be recorder, observer, clean up, set up, artist, and safety.
- As an alternative or an additional investigation, use copper pennies instead of the stainless steel spoon. The vinegar will turn green.

Additional Support

- DI Spatial learners should be encouraged to draw the set up and pictures of their predictions and observations.
- Some students may need a warm up demonstration to show the composition of eggshells and their reaction with vinegar. Place a small bit of chalk into some acid and watch bubbles form and the chalk shrink. Explain that eggshells are made of chemicals similar to chalk.
- Enrichment—Some students may want to know how these experiments connect to real life. Invite ideas from volunteers. Explain that vinegar is corrosive and reacts with different metals in different ways. This could stimulate a class discussion of how acid precipitation will act on metals left outside.

Answers

1. Colour change. The steel wool will rust when placed in vinegar. It should turn brown and might feel hot.
   Colour change. The stainless steel should get shiny after being in vinegar. If using pennies, the solution around the pennies should turn green and the pennies should get shiny.
   Gas is produced. The baking soda and vinegar will bubble immediately.
   Shell decomposes; gas is produced. The vinegar will dissolve the eggshell. If the egg is left in the vinegar, the cell membrane will break and the egg will leak into the solution. Bubbles will form on the shell as it breaks down.
2. It is safe to dispose of these chemicals like household garbage. Put the solids in the garbage and pour the vinegar down the drain and rinse with water. Acids react with metal, so the drain could be damaged by the vinegar. The metal leached into the vinegar will enter the drinking water and could be toxic. If the experiment had used battery acid, the acid should be neutralized using a base like baking soda before disposal.

Instructional Strategies for Topic 2.6

Compounds and elements are changed during chemical reactions. (Student textbook pages 142–143)

- Before reading, discuss the meaning of the words *desirable, undesirable, reactants,* and *products.* Have students give examples of desirable and undesirable characteristics in foods or music. Explain that a chemical reaction converts reactants into products. Review the indicators of a chemical change.
- Ask students to scan the photographs and predict some of the desirable or undesirable products of reactions.
- ELL Support English language learners' understanding of key instructional language by providing synonyms (scan/look through) or by using visuals to represent pros and cons, such as a happy face and a sad face.
- Enrichment—Challenge students to make a poster that advertises a reaction and includes the benefits and consequences.

The properties of substances that make them useful can also make them dangerous. (Student textbook pages 144–145)

- Before reading, discuss Figure 2.18, which shows the Hazardous Household Product Symbol (HHPS) for bleach, and then have students complete Activity 2.13. This will give them hands-on experience with products and labels before reading about them.
- ELL For Learning Check question 1, ensure that English language learners understand how to use a T-chart.

- Allow students to share stories that they have heard about chemicals and their hazards, such as exploding toilets or hands reduced to bones. If students do not volunteer stories, you could also use a think-aloud strategy as you read the text to clear up students' misconceptions and encourage class discussion.

There are less-harmful alternatives to many products we use and depend on.
(Student textbook pages 146–147)

- ELL Prior to discussing alternative cleansers, have English language learners discuss cleaning practices to give them an opportunity to use vocabulary associated with these routines. Create a list of key vocabulary that will help them follow the before reading discussion and more easily read the text. Talk about what is meant by an alternative cleaning product and explain why finding less harmful cleaning products has become an issue.
- Ask students if they or their families use alternative cleaners, such as microfibre cloths, and why they choose these products (allergies, environmental concerns). Ask students to list cleaning alternatives they know about or use.
- After reading, ask students why the alternatives are safer but not harmless.
- ELL Explain the meaning of "100 percent safe" in Learning Check question 2 for English language learners.
- Students could create an advertisement that compares a traditional cleaning product with an alternative product.

Learning Check Answers (Student textbook page 143)

1. The chemical and physical properties of the chemicals change in a chemical reaction.
2. Two desirable products of a chemical reaction are light energy and heat energy.
3. Undesirable products of combustion are gases that produce acid rain.

Activity 2.12 Analyze Some Chemical Reactions

(Student textbook page 143)

Pedagogical Purpose

In this activity, students use their prior knowledge to analyze the benefits and consequences of common chemical reactions.

Planning	
Materials	**BLM 2-31 Activity 2.12** (optional)
Time	20 min

Skills Focus

- think critically
- explain and support reasoning

Activity Notes and Troubleshooting

- To decrease the amount of time needed to complete this activity, have students form five groups and assign a picture to each group.
- Students might find it difficult to think of two more chemical reactions on their own. Provide hints to help them describe these reactions. Suggest they look at the photos in the topic for examples of corrosion and synthesis.
- Students could use point form or a graphic organizer for their answers.

Additional Support

- ELL Students should work in small groups to help each other decode the reactions. Pair English language learners with students who have strong English language skills and allow them access to the Internet for assistance. Some English language learners may need some modelling of the thinking process used to answer question 2 and 3. Use one of the pictures and talk aloud, discussing how you would answer each of the four questions. Model the process of thinking about questions 2 and 3, and recording your responses to each question.
- Supply **BLM 2-31 Activity 2.12** to students who need support interpreting the photos.
- Suggest students find videos of different reactions to show to the class. Excellent examples are the explosive reaction of cesium and water or the reaction of Mentos and Coke.
- Allow students to choose the format of their responses. For example, they could use a picture, a poem, a song, or a rap. Allow them to present their answers to the class to showcase their talents.

Activity 2.12 Answers

Reaction	1. Description	2. Is reaction useful?	3. Social and environmental effects
rusting	Iron + oxygen → iron oxide + heat	No. Destroys iron in vehicles, bridges, and buildings.	Costly to repair. Can make vehicles or bridges unsafe.
food spoilage	Food + oxygen + mould → carbon dioxide + water	No. Destroys food. Yes. Decomposition is important in ecosystems.	Ruined food is costly. Can cause food poisoning. Allows nutrients to be recycled.
combustion	Fuel + oxygen + heat → carbon dioxide + water + heat	Yes. Important for transportation.	Produces greenhouse gases which cause global warming.
cellular respiration	Sugar + oxygen → carbon dioxide + water + energy	Yes. Provides energy to all living things.	Carbon dioxide contributes to global warming.
photosynthesis	Carbon dioxide + water + sunlight → sugar + oxygen	Yes. Provides energy to plants.	Produces oxygen which is necessary for life.
4. Answer may vary. For example:			
neutralization/acid corrosion	Acid + base → salt + water	Yes, Useful in cooking.	Destroys statues.
synthesis	Nitrogen + hydrogen → ammonia	Yes. Used to produce fertilizer.	Fertilizer run-off can poison streams and lakes.

Learning Check Answers (Student textbook page 145)

1.

Useful	Harmful
- kills bacteria - bleaches stains	- poisonous if ingested - harmful to eyes

2. a)

b)

3. poison

Activity 2.13 What's On a Label? (Student textbook page 145)

Pedagogical Purpose

In this activity, students will increase their scientific literacy by learning how to read a product label and determine its uses and dangers.

Planning	
Materials	Several containers of six different household products or their labels (for example, toilet bowl cleaner, bleach, window cleaner, furniture polish, baking soda, turpentine)
Time	15 min
Safety	Do not open the containers. Many household products are dangerous if handled improperly.

Skills Focus

- interpret HHPS
- explain and support reasoning

Activity Notes and Troubleshooting

- Students can work in pairs or small groups.
- If there are not enough containers or labels, have students work in larger groups. Or have half the class complete the activity while the other half completes the Learning Check questions and watches a video on how to avoid household accidents. (Mythbusters is a good video resource.) After the whole class has done the activity, students can share their answers.
- Allow students to choose the product they want to examine. Or assign the products by lottery. Alternatively, you could set up stations with one product at each station, and have students rotate through the stations.
- Discuss how to handle the containers safely and where to look on the label to find the safety information.
- Inform students that not all labels will have the ingredients listed (due to secrecy in the industry) but that the important or hazardous chemical must be listed and will often be found after the words "caution contains."

Additional Support

- ELL The syntax of some of the questions may pose difficulties for English language learners. Explain what is meant by "What, if any" in questions 3 and 4. Read question 5 starting with "design a suitable . . ." and ask them how the question changes when you read from the beginning of the sentence.
- DI ELL Spatial and English language learners might benefit from using flash cards to match HHPS and WHMIS with their meanings.
- Ask students to demonstrate their understanding by describing potential hazards and consequences of not following the safety instructions for each symbol.
- To complement this topic, show students videos that depict household accidents and discuss how the accidents could have been prevented or predicted.
- Enrichment—Have students prepare a wanted commercial or poster for their product, showing the dangers of the product and the steps required in "apprehending" it.

Activity 2.13 Answers

Answers for questions 1 to 5 will vary depending on the product. This sample answer is for bleach.

1. Bleach is used to remove stains from clothing and to disinfect surfaces.
2. Bleach contains ammonia.
3. The HHPS warns that bleach is a poison.
4. If you get bleach in your eyes, you should flush them with water. Bleach should not be ingested and if it is, you should drink large amounts of water. Keep the product out of reach of children. You should not mix bleach with other cleaners.
5. Product has a HHPS.
6. HHPS warn of similar dangers (flammable, explosive, poison) but the shape around WHMIS is always a circle and some of the dangers are sub-divided, such as poison and toxic. WHMIS also warn of dangers not covered by HHPS, such as highly reactive.

Activity 2.14 Which Would You Choose? (Student textbook page 147)

Pedagogical Purpose

In this activity, students will design their own tests to assess and compare traditional and alternative cleaning products.

Planning	
Materials	3 or 4 cleaners, such as window cleaner, stain remover, and laundry detergent 3 or 4 surfaces, such as glass, mirror, and fabric oil or markers (to stain surfaces) vinegar lemons baking soda cloths or paper towels
Time	30 min
Safety	Read labels and HHPS before using products. Wear safety goggles and gloves.

Skills Focus

- design an experiment
- make comparisons

Activity Notes and Troubleshooting

- Choose a variety of mild cleaners for students to test. Good examples are window cleaners, laundry detergent, and stain remover.
- It might be more practical to select the surfaces first and then find products that are used to clean them.
- Do not use oven cleaner or drain cleaner in this activity. Both are very strong bases and are difficult to compare in a lab situation.
- Discuss the importance of controlling some variables, such as how long the treatment is applied, so that results can be compared fairly.
- Have students give you a written plan or flowchart for their test before you hand out the materials. This will help you ensure students' tests are safe and effective.
- Model how to determine the cost of a treatment by showing how to divide the volume of the cleaner used by the volume of the container and to multiply the cost of the cleaner by that decimal value.

Additional Support

- ELL Review the language of experiments with English language learners (variables, control, placebo, etc.) as well as vocabulary used in the activity (commercially, functionality, criteria).
- Show commercials that compare the ability of different cleaners to remove stains. Compare the commercials to scientific tests that use a control or placebo. Ask students to identify any bias in the commercials or to suggest how the tests could be more fair.
- Consider testing one product with students to model an effective test. For example, you could model how to test stain removers and then challenge them to test laundry detergents.
- Some students may require specific instructions. Provide a template to complete that directs these students through this inquiry, listing volumes to use and times to wait.

Activity 2.14 Answers

What Did You Find Out?

Answers will vary.

1. The best product will work well at a low cost. Explanation should refer to both effectiveness and cost.
2. Students may choose criteria mentioned by other groups. Criteria should relate to the product chosen and could include safety, ease of use, or scent.
3. Answer should show a comparison to other students' findings. Students should use their results to justify their opinions.

Learning Check Answers (Student textbook page 147)

1. We use cleaning products that are hazardous because their benefits seem to outweigh their risks.
2. Baking soda would be safer to use than oven cleaner because it is not as corrosive. It is still corrosive though so it is not completely safe.

Investigation 2C Identifying an Unknown Gas

(Student textbook pages 148–149)

Pedagogical Purpose

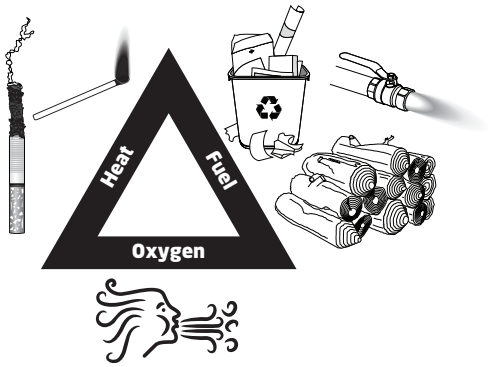
In this activity, students apply their knowledge of safe laboratory practices to perform experiments on gases and use the results to identify the gases based on their chemical properties.

Planning	
Materials	Per set of tests: 10 mL dilute hydrochloric acid small piece of mossy zinc 5 mL 3% hydrogen peroxide 5 mL limewater yeast marble or limestone chip 4 test tubes test tube rack test tube holder 2 rubber stoppers 2 wooden splints balloon **BLM 2-32 Investigation 2C** (optional)
Time	20 min
Safety	Students should wear safety goggles and aprons. Remind students to be cautious when testing for gases and to be careful when handling the burning splints. Have students extinguish splints immediately after use.

Background

The gases being tested in this experiment all share similar physical properties: they are clear, colourless, and odourless. Their chemical properties are used to distinguish them. Hydrogen is explosive and oxygen supports combustion. Carbon dioxide reacts with limewater to make a precipitate of calcium carbonate, which is insoluble in water. Knowing how to identify an unknown gas safely can prevent accidents.

CO_2 fire extinguishers contain dry and wet chemicals that are mixed when the extinguisher handle is depressed. This causes the production of CO_2, which removes oxygen from a fire and puts the fire out. The fire triangle is an excellent tool to discuss with students and highlights the characteristics of oxygen and carbon dioxide in fire control.



Skills Focus

- follow laboratory safety procedures
- perform an experiment
- draw conclusions based on data

Activity Notes and Troubleshooting

- Manganese dioxide can be used in place of yeast to catalyze the conversion of hydrogen peroxide into water and oxygen. Use less than 1 mL and be prepared to scrub the test tubes afterward as the powder will leave a black residue.
- This investigation is very effective as a demonstration. Ask students to predict how they will know what gas is formed based on the known properties of the gases.
- If students are completing the investigation, set up several stations that have only the materials required for the test. For example, the station testing for hydrogen would have 5 mL hydrochloric acid in a test tube, a splint, and a piece of mossy zinc. This will reduce confusion over how to make each gas. Have students rotate through the stations to complete the Investigation.
- Have students work in small groups of up to four and assign each student a test to prepare and an organizational duty such as safety, clean-up, or recording.
- Students should be shown how to test for each gas prior to the experiment being performed. Stress the importance of wearing safety goggles. Warn students not to point the mouth of the test tube at anyone. If too much gas builds up while the stopper is on, the stopper can fly off and cause an injury.
- Remind students that they must act quickly to test the gases they produce. Hydrogen and oxygen are lighter than air and will escape the test tube as soon as the stopper is removed.

Additional Support

- DI ELL For spatial learners, English language learners, and others, place cards at each station showing how to perform the test in point form and in pictures. Label the materials.
- Place cards at each station for students to record their observations.
- Enrichment—Prepare a sample of mystery gas. Ask students how they would determine its composition. Have them decide on the type of tests needed and their order. Then perform the tests and see if students can identify the gas.

Investigation 2C Answers

What Did You Find Out?

1. The physical properties of the three gases: clear, colourless, and odourless. Cannot use their physical properties to tell them apart.
2. Flammability is the property used to distinguish the gases. Hydrogen is explosive, oxygen supports combustion, and carbon dioxide extinguishes the flame.
3. Carbon dioxide puts out flames so it could be used in a fire extinguisher.

Using Making a Difference (Student textbook page 150)

Literacy Support

Before Reading

- Have students work in small groups to brainstorm answers to the questions below. Then discuss the ideas as a class. You could use a graffiti format or simply write their answers on the chalkboard.
  - Are there products in your home that could be replaced with safer, less expensive alternatives?
  - How do you dispose of hazardous wastes at home?
  - What type of wastes do you produce at home?
  - How can you dispose of biowaste or electronic waste in your community?
  - In what ways can you have a valuable impact or make an important contribution in your community?
- ELL Review the questions to be discussed with English language learners. Ensure that they understand the language of the questions and give them an opportunity to think about and share examples. An alternative approach which gives them an opportunity to think before group discussion would be to have them jot down ideas in their first language.

During Reading

- Have students look at the photo of Adrienne Duimering with her science fair project. Ask students how long they think she took to think up her topic or complete her project. Challenge students to make their own science fair proposal. Note that there is a Canada wide fair that your class could enter.
- ELL Describe a Science Fair to those English language learners who may not be familiar with these kinds of events.

After Reading

- Ask students how the photo of Sarah Mediouni relates to her contribution to her community. Discuss how students deal with insects at their homes and the challenges people might face if pesticides are banned in their communities.

Instructional Strategies

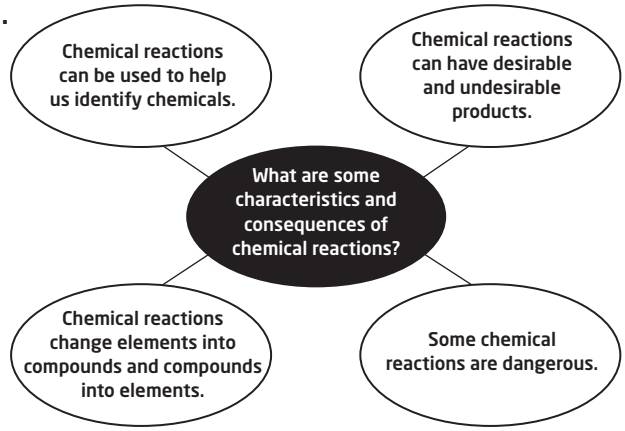
- Students could use a placemat activity while reading to organize their responses to the two stories. Students could respond to prompts such as: "Could you do this?" "Are you interested in doing something like this?", and "Who could you talk to about getting involved in something like this?"
- Challenge students to get involved in finding a solution to one of the waste issues discussed before reading. As a class, discuss what steps need to be taken to reduce electronic waste (for example). Invite a member of your local council to your class to discuss the issue.

Topic 2.6 Review (Student textbook page 151)

Please see also **BLM2-33 Topic 2.6 Review (Alternative Format)**.

Answers

1.



2. Chemical reactions are important to us because we use them to clean our homes, make our food, and get energy from our food.

3. No, sometimes the products of a chemical reaction are not desirable. An example of this is when acid rain reacts with a marble statue and starts to eat away at the stone.

4. Answers will vary. Students should mention alternatives and control mechanisms in their responses.

5. a)

Evidence	Inferences
- burning splint did not pop - glowing splint did not relight - limewater turned cloudy	- the gas is not hydrogen - the gas is not oxygen - the gas is carbon dioxide

b) The gas is carbon dioxide. It turned the limewater cloudy.

6. Liming a lake is not a permanent solution because acid is continually added to the lake but lime is not. The water acidity will rise again once the lime has reacted with the acid.

Using Science at Work (Student textbook pages 152–153)

Instructional Strategies

- Before reading this section, brainstorm careers that would use information or skills from each section in this topic (properties are used by jewelers, knowledge of safety is used by cleaning staff, etc). Then discuss how knowledge of chemicals and chemical reactions can be useful while cooking. (Remind students of how vinegar and baking soda react).
- Read the first paragraph together, then have students answer the first Over To You question.
- Invite volunteers to read the interview aloud, with some students taking on the role of Florell and other students pretending to interview her. After reading the interview, have students answer the next Over To You question and discuss the challenges Florell may face because of her hearing impairment.
- Discuss the concept map on page153 and ask students which careers interest them. For each career, discuss the training and chemical knowledge they would need.
- Have students draw an education and experience flowchart that would lead them to one of the careers in their future. Will they need to do an apprenticeship, go to college, or go to university? As well as formal education, what else could help them achieve their goals?
- Have students list the skills they would need to be successful at a career they are interested in, the challenges they would face, and any questions they have about the career.

Additional Support

- DI Linguistic and bodily-kinesthetic learners will enjoy role-playing the interview with Florell.
- ELL English language learners and other students may need short descriptions of each career. Talk with the class about tasks and working conditions that someone in each career might encounter.
- Enrichment—Ask students to create a one paragraph advertisment for their career or find an advertisment in the newspaper or on the Internet for their chosen career. Provide samples of advertisements for them to use as a model.

Science at Work Answers

Over To You

1. Baking involves chemistry by applying the knowledge of how the properties of chemcials will change when they are combined.
2. Bakers need good organizational skills so that they can find the equipment they need and good planning skills so that they have the necessary ingredients on hand.
3. Answers will vary. Students should list the essential skills and training required for their chosen career.