Chapter 4 Developing Chemical Equations

Materials

Please see the teaching notes for each activity for a list of the materials required. Please see page TR-31 for a summary of the materials required in this chapter and other chapters.

Advance Preparation

- A month before beginning, order sets of nomenclature playing cards from a supplier.
- Reserve one period in your school's resource centre for Green Chemistry Case Study research.
- Gather baking soda, citric acid, universal indicator, lemon juice, eggs, toothpastes and whiteners, paint brushes, tea, and resealable plastic bags.
- Prepare paper-pulp waste water, 0.1 mol/L sodium hydroxide, 0.1 mol/L iron(III) nitrate, and dropper bottles of potassium iodide, silver nitrate, barium hydroxide, and 0.5 mol/L sulfuric acid.
- Create a space in the classroom for a "Chemistry Word Wall."
- Locate models of a crystal lattice (e.g., NaCl) and a molecular substance (e.g., CO_2).
- One week before, prepare a set of colourful construction paper circles with magnets representing electrons.
- Students can review the Key Terms in Chapter 4 using **BLM 4-3 Chapter 4 Key Terms**.

In this chapter, students use their understanding of atomic structure and Bohr-Rutherford diagrams to draw models of elements forming compounds, to classify chemical compounds as ionic or molecular, to name compounds, and to write chemical formulas. Students also examine the law of conservation of mass and use it as the foundation for balancing chemical equations. The Green Chemistry Case Study encourages students to explore environmental implications of the law of conservation of mass as it applies to chemical manufacturing.

Using the Chapter Opener (Student textbook pages 136 and 137)

- Ask students to identify what is shown in the photo. How does this show the everyday application of chemistry? How much time does an air bag have to inflate and protect the occupant? (Answer: 25 milliseconds) Clarify that the nitrogen gas used to inflate air bags in an accident is produced instantaneously by a three step reaction. Sodium azide (NaN_3) and potassium nitrate (KNO_3) react very quickly to produce a nitrogen gas (N_2). This gas expands instantaneously due to the heat of the reaction. The pressure of the gas causes the bag to literally burst out of its containment.
- Draw out students' understanding of the periodic table and properties of elements by examining nitrogen to determine why it is used. (e.g., because it is non-toxic and less reactive than other options, reducing the chance of fire).

Alternative Context

Have groups of five students write the names (first and last) of their grandparents, parents, aunts, and uncles on small slips of paper. Each person's name should be on a separate slip of paper. Have the groups trade slips. After mixing the slips, have the rest of the class organize the people into family groups, identifying each person as male or female. Have them identify other possible links. What clues in the names helped them?

Explain that a more rigid set of naming rules is used for chemicals. The rules agreed upon by the International Union of Pure and Applied Chemistry (IUPAC) make it possible to learn a lot about the chemical from its name alone. For example, what elements make it up, the proportion of the elements, and what other chemicals it may behave like (e.g., acids). Because this worldwide association set the standard, scientists around the world, speaking any language, can reliably share information.

Before the IUPAC standard was used, every culture used its own methods for naming and talking about chemicals. Often names were based on how the chemical looked, or where it came from but nothing about its chemical composition.

Activity 4-1 Making a Reaction Happen (Student textbook page 137)

Pedagogical Purpose

This activity reactivates prior knowledge and gets students thinking about chemical reactions, the conditions under which they occur, and evidence of chemical change.

Planning		
Materials	Baking soda Scoops Resealable plastic bags	Citric acid Water
	Begin gathering materials one week before the activity, one scoop of material for each student or pair.	
Time	Approximately 25 min in class	

Background

The reaction produces a gas only when water is added to allow the substances to mix.

Activity Notes and Troubleshooting

- Set up four stations to minimize congestion, one for each material.
- Discuss that some reactions are not spontaneous but require the right conditions. (e.g., fireworks, glow sticks, hot packs, or hair dye). From this students should establish that these reactions need some help (e.g., ignition).
- Reactivate understanding of the two types of observations (qualitative and quantitative) to discourage students from including inferences in their observation tables. Distinguish between an observation and an inference by defining each. You may wish to use **BLM A-1 Making Observations and Inferences Checklist** for this activity.
- Discuss descriptive and more precise language options to be used when making observations (e.g., blue-green is more precise than "bluish").
- Review standard safety practices, such as wearing safety glasses, washing hands, cleaning up the work area, and disposing of waste.
- You may wish to use this opportunity for students to practise with graduated cylinders, first demonstrating how to measure 10 mL of water.
- Show students how much of each substance to spoon into the bag and demonstrate a technique for keeping the water separate from the powders.

Additional Support

- DI This is a good hands-on activity for bodily-kinesthetic learners.
- ELL English language learners may benefit from a demonstration or set-up to model. Alternatively, perform the procedure as a class as the steps are read aloud.
- Encourage students with visual impairments to listen and smell (by wafting) for clues of a change.
- Provide a copy of the observation chart. As further support, you may wish to include a checklist of possible observations (including distractors).
- Rather than manipulating the bags to keep substances separate, you may wish to provide the water, baking soda, and citric acid in small open containers (such as water bottle caps) that can be placed in the bag, then inverted at the right time.

Study Toolkit

Strategy	Page Reference	Additional Support
Skim, Scan, or Study	For page 145, students can identify the purpose of Table 4.4 and describe a suitable reading approach.	Refer students to the Study Toolkit Overview, in particular the section Preparing for Reading: Previewing Text Features, on page 560 of the student textbook.
Base Words	For page 152, students can evaluate *molecular* to link it to molecule, and derive the meaning "relating to molecules."	Refer students to Study Toolkit 3 Word Study: Common Base Words, Prefixes, and Suffixes in Science, on page 564 of the student textbook. Work with English language learners to identify prefixes and suffixes that can help them understand important words throughout the chapter. You may wish to use **BLM G-40 Word Study** for this activity.
Identifying the Main Idea and Details	After reading page 162, students can draw a spider map to show the main idea and supporting details in the text.	Refer students to Study Toolkit 4 Organizing Your Learning: Using Graphic Organizers, on page 565 of the student textbook. You may wish to use **BLM G-45 Spider Map** for this activity.