UNIT D Science in My Life (page 256)

SUGGESTED TIMING

75 min or less including brainstorming and discussion of how scientific inquiry might be used

BLACKLINE MASTERS

BLM D–1 Reading a Graph
OHT 23 Using Scientific Inquiry
OHT D–1 Scientific Processes

Overall Expectations

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

Activity Planning Notes

This opener is intended to provide you with some idea of what students already know about scientific processes and the skills they will use in this unit. It will also encourage students when they see that they already know about how science is used in everyday life.

Have students complete the herringbone organizer on page 256. If they are unsure of which scientific processes they have used, encourage them to refer to the chart on page 7 or put **OHT D–1 Scientific Processes** on the overhead projector. Point out that students should list how they have used the process in their daily life, not in science class. You may wish to fill in one or two processes and uses as a class before students attempt to list more on their own.

Students can share their results with a small group or with the class. They can add to their own charts based on ideas that other students mention. Alternatively, you may wish to discuss each process as a class, giving students a few minutes after each process is discussed to think of and add an example from their own life to page 256.

Then work with students on the material on page 257. One strategy that you could use is called think-pair-share.

1. **Think.** Provoke students' thinking with a question, prompt, or observation. Students should then take a minute just to think about the question and possibly jot some notes down in their student resource.
2. **Pair.** Using designated partners, students pair up to talk about their answers. They compare their mental or written notes and identify the answers they think are best, most convincing, or most unique.

3. **Share.** After students talk in pairs, call for each pair to share their thinking with the rest of the class. You can do this by going around in round-robin fashion, calling on each pair, or you can take answers as they are called out (or as hands are raised). Record these responses on the chalkboard or on **OHT 23 Using Scientific Inquiry**.

After students have worked with the questions on page 257, you might review material from How to Think Like a Scientist by asking the following questions:
- What is a fair test?
- What is a manipulated variable? responding variable? controlled variable?
- Why do you use more than one trial when you are doing an experiment?
- How do you find the average of 10 cm + 15 cm + 5 cm? What is the average?

Diagnostic Assessment

The brainstorming with the class should give you a sense of students' general understanding of scientific processes. Students may already have a good idea of these processes, which they have been using since the opening section, How to Think Like a Scientist. Some things to consider include
- What processes are students the most familiar with?
- What processes have students used repeatedly throughout the course?
- What processes do students need further experience with?
- What processes are students unfamiliar with?

Put **BLM D–1 Reading a Graph** on the overhead projector or distribute copies. Have students use the blackline master and make notes about the graph.
- What does the horizontal (bottom) line on the graph tell you?
- What does the vertical line on this graph tell you?
- How fast was this cyclist going at 2 s? (4 m/s)
- How long did it take for the cyclist to reach a velocity of 8 m/s? (4 s)

Consider using the following blackline maser and overhead transparencies:
- **BLM D–1 Reading a Graph**
- **OHT 23 Using Scientific Inquiry**
- **OHT D–1 Scientific Processes**

Answers to Questions (page 257)

1. Answers will vary. Students may suggest that knowing about scientific inquiry helps make you a better chef because you understand how ingredients work together, how to invent new recipes, and how to make and test changes to recipes.
2. Answers will vary. Students should be able to identify that tools for measuring mass, volume, temperature, and time are used in science and in cooking.
3. Answers will vary. Sample answer: You could test whether one brand of toothpaste works better than another brand for removing a stain.
4. Answers will vary. Sample answer: You could use a scientific test to determine which sports shoes have the best grip or which brand of tennis balls bounces the highest.

Activity Preparation for Chapter 14

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
What's Going On? Watch Yeast Grow (page 259) (TR page 317)	• 2 to 3 days before – Gather materials. • Day of – Set out materials.	• 20 min	• Demonstrate the procedure for the students. Make sure that the water is lukewarm. If it is too hot, it will kill the yeast.
Test It! Plan Your Own Investigation (page 260) (TR page 319)	• 2 to 3 days before – Gather materials. • Day of – Set out materials.	• 15 min to plan activity • 15 min to set up activity • 5 min each hour for the next several hours to record observations	• Demonstrate the proper method of smelling any type of chemical or chemical reaction. You do not want students to put their face close to the beaker of yeast. Instead, you want them to keep their face away from the beaker and use their hand to "wave" the fumes toward their nose.
Test It! Raising Agent Race (page 266) (TR page 323)	• 2 to 3 days before – Gather materials. • 1 day before – Organize the apparatus and materials. Put materials into small containers, one container per group. – Photocopy **Assessment Master 3 Lab Report Checklist** and **Assessment Master 4 Lab Report Rubric**.	• 10 min to set up the graduated cylinders • 10 min for the reactions to take place • 20 min to record observations, draw the graph, and answer questions • 5 min to clean up	• If you are going to do this as a class activity, you might want to **1.** Pre-assign your groups into teams of three students to save time. **2.** Have all the materials and equipment set out for the students.
Try This! (page 267) (TR page 326)	• 2 to 3 days before – Gather materials. • 1 day before – Organize the apparatus and materials. Place all the materials students need into small containers, one container per group. – Photocopy pages 266 and 267 and make an overhead projection.	• 10 min to set up the graduated cylinders • 10 min for the reactions to take place • 20 min to record observations, draw the graph, and answer questions • 5 min to clean up	• If you are going to do this as a class activity, you might want to **1.** Pre-assign your groups into teams of three students to save time. **2.** Have all the materials and equipment set out for the students.

Materials Needed for Chapter 14

Activity/Investigation	Apparatus	Materials	Blackline Masters
What's Going On? Watch Yeast Grow (page 259) (TR page 317)	For each group: • 500 mL beaker • spoon • magnifying glass (optional)	For each group: • 250 mL warm water • 5 mL white sugar • 15 mL active dry yeast	
Test It! Plan Your Own Investigation (page 260) (TR page 319)	For each group: • mixing bowl or beaker • measuring cup • measuring spoon • 3 – 1 L plastic pop bottles • 3 balloons • flexible tape measure (optional)	For each group: • white sugar • active dry yeast • string or tape	
Test It! Raising Agent Race (page 266) (TR page 323)	For each group: • marker • 3 – 250 mL graduated cylinders • timer	For each group: • masking tape • 5 mL baking soda • 5 mL cream of tartar • 5 mL baking powder • 1 egg white mixed with 200 mL cold water	**Recommended** OHT D–2 What Did You Observe? Assessment Master 3 Lab Report Checklist Assessment Master 4 Lab Report Rubric
Try This! (page 267) (TR page 326)	For each group: • marker • 3 – 250 mL graduated cylinders • timer	For each group: • masking tape • 5 mL baking soda • 5 mL cream of tartar • 5 mL baking powder • 200 mL cold water	**Recommended** OHT D–2 What Did You Observe?

CHAPTER 14 Science in Cooking (page 258)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
30 min	• piece of bread • toaster • baking soda • clear drinking glasses • white vinegar in a clear plastic bottle • marshmallow • aluminum pie plate • fireplace lighter (butane lighter) • milk • stir stick • 2 raw eggs • boiling water	BLM 14–1 Did a Chemical Change Take Place?

Overall Expectations

SILV.01 – illustrate how science is a part of daily life
SILV.02 – use appropriate scientific skills, tools, and safety procedures to investigate problems
SILV.03 – examine the connections between science and activities in daily life
BSAV.01 – explain the systems and processes required by simple and complex organisms to sustain life
BSAV.02 – investigate, through laboratory activities, the processes which simple and complex organisms use to sustain life
BSAV.03 – analyze how personal health and safety in everyday life and in the workplace are protected through the proper use of equipment and safety practices
CPMV.01 – explain the characteristics and classification of common materials, using appropriate scientific terminology
CPMV.02 – investigate the physical and chemical properties of common materials through laboratory activities
CPMV.03 – analyze how the use of various materials is based on their physical and chemical properties

Key Terms Teaching Strategies

The key term is chemical change. Consider setting up a series of demonstrations for your students as outlined in the following Activity Planning Notes.

Activity Planning Notes

Photocopy **BLM 14–1 Did a Chemical Change Take Place?** for your students. This worksheet includes a table similar to the table on page 258 and a related exercise. Perform the following demonstrations.

- Demonstration A: Bread + Heat
  Display a piece of bread and have students describe its texture and colour. They can record the colour of the bread on **BLM 14–1 Did a Chemical Change Take Place?**
  Toast the piece of bread in a toaster, and then have students describe the bread's change in colour. They can record their descriptions on the blackline master. Ask, "Does this demonstration meet any of the other criteria for evidence of chemical change?" (Answer: The change cannot be reversed.)

- Demonstration B: Baking Soda + Vinegar
  Add 2 or 3 teaspoons of baking soda to a clear glass. Ask students to describe the baking soda and record its appearance on **BLM 14–1 Did a Chemical Change Take Place?**
  Show students the clear plastic bottle of white vinegar. Ask them to describe the white vinegar and record its appearance on the blackline master. Pour some vinegar quickly into the baking soda and have students record their observations (bubbles appear or a gas is formed). Ask, "Does this demonstration meet any of the other criteria for evidence of chemical change?" (Answer: The change cannot be reversed.)
- Demonstration C: Marshmallows + Heat
  Place a marshmallow in an aluminum pie plate. Ask students to describe the marshmallow and to record their description on **BLM 14–1 Did a Chemical Change Take Place?** Use a fireplace lighter to ignite the marshmallow. Ask students to record their observations on the blackline master (heat and light is produced). Ask, "Does this demonstration meet any of the other criteria for evidence of chemical change?" (Answer: The change cannot be reversed and bubbles may form.)
- Demonstration D: Milk + Vinegar
  Place about 100 mL of milk in a clear glass. Ask students to describe the milk and record their descriptions on **BLM 14–1 Did a Chemical Change Take Place?** Add approximately 15 mL of vinegar to the milk and stir. Ask students to record their observations (a solid is formed). Ask, "Does this demonstration meet any of the other criteria for evidence of chemical change?" (Answer: The change cannot be reversed.)
- Demonstration E: Egg + Heat
  Crack one of the raw eggs into a clear glass. Ask students to describe the raw egg and record their descriptions on **BLM 14–1 Did a Chemical Change Take Place?** Place the second raw egg in the boiling water and leave it for about 10 min. Once the egg has cooled, cut it in half. Ask students to record their observations on the blackline master (the change cannot be reversed, heat is absorbed). Ask, "Does this demonstration meet any of the other criteria for evidence of chemical change?" (Answer: There is a colour change. The egg white and yolk change colour.)

Check Your Understanding Answer (page 258)

1. Students should be able to identify that once an egg is cooked the changes cannot be reversed. Students might also point out that depending on the method of cooking, a solid may be formed and there may be a change in colour. If students point out that bubbles appear when an egg is fried, discuss how those bubbles are caused by air getting trapped in the egg white. The bubbles are not evidence of a chemical reaction.

Alternative Activity

- Ask students to imagine that they are test kitchen chefs with their own television program. They can prepare a segment for their viewers in which they describe evidence that food changes chemically when it is cooked.

14.1 Chemical Change and Making Bread (page 259)

SUGGESTED TIMING

20 min for What's Going On?
30 min plus 5 min for the next several hours to record observations for Test It!

MATERIALS

- sample of leavened and unleavened brad
- bread knife

Specific Expectations

SIL1.01 – describe how the procedures, skills, and tools employed in different areas of science are also evident in daily life
SIL1.02 – explain the importance of a "fair test" for troubleshooting and testing everyday science problems
SIL2.01 – formulate questions about problems or issues that can be scientifically tested
SIL2.02 – plan, conduct, and refine simple investigations to answer student-generated questions
SIL2.03 – conduct investigations safely, using appropriate lab equipment
SIL2.04 – observe and record data, using a variety of formats, including the use of SI units, where appropriate
SIL2.05 – assess data to make inferences and conclusions and to answer questions and refine procedures
SIL2.06 – communicate plans, observations, and results using a variety of oral, written, and graphic representations, and including the use of SI units, where appropriate
SIL3.01 – develop and investigate research questions about an everyday science-related topic of personal interest
SIL3.02 – evaluate the investigation of the topic they selected and suggest possible refinements
SIL3.03 – demonstrate an understanding of how problem-solving and decision-making activities in the workplace use scientific process skills

Activity Planning Notes

Consider bringing in two samples of fresh bread, one of leavened bread and the other of flat or unleavened bread. Slice the bread into thin slices and have students compare the structure of each type of bread. Ask, "What are the similarities and differences between the two types of bread? What do you think caused one of the breads to appear fluffier than the other?" Link student responses to evidence of chemical change (a chemical reaction that releases bubbles must have taken place in the leavened bread).

Technology Links

For more information on yeast, go to **www.mcgrawhill.ca/books/Se9** and follow the links to The Science of Cooking.

What's Going On? Activity (page 259)

Watch Yeast Grow

Purpose

- Students observe evidence of a chemical change when yeast is added to sugar and warm water.

Science Background

Most living things use cellular respiration in order to grow and reproduce. The general reaction for cellular respiration is that glucose plus oxygen produces carbon dioxide and water vapour.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	• Gather materials.
Day of	• Set out materials.

APPARATUS	MATERIALS
For each group: • 500 mL beaker • spoon • magnifying glass (optional)	For each group: • 250 mL warm water • 5 mL white sugar • 15 mL active dry yeast

Suggested Timing

20 min

Safety Precautions

- Remind students never to eat anything that has been made in a science room.
- Students should clean up the work area and wash their hands thoroughly at the end of this activity.

Activity Planning Notes

Demonstrate the procedure for the students. Make sure that the water is lukewarm. If it is too hot, it will kill the yeast.

Once all of the ingredients have been mixed together, you might have students observe the yeast mixture with a magnifying glass. They should be able to see the gas bubbles forming in the yeast mixture.

Make sure that students record observations gathered through smell and touch as well as sight.

Accommodations

- Consider grouping students with physical and/or learning disabilities with students who do not have these challenges.
- Students who are visually impaired may be able to help other students describe the odour of the growing yeast cells.

What Did You Observe? Answers (page 259)

5. Students will likely comment that the mixture looked slightly cloudy, with some clumps of yeast on the surface. They may also notice some yeast settling to the bottom of the beaker.
6. Students will likely comment that the mixture was completely cloudy with foam on the surface. They will notice the strong yeast smell, but most likely will not detect any temperature change.
7. The bubbles produced make the bread lighter.

Activity Wrap-up

- Make the link to the Test It! Plan Your Own Investigation on the next page by asking leading questions such as
  – What are three things that yeast needs to grow? (Answer: water, warm temperature, sugar (food))
  – How do you think this activity is linked to the two types of bread that you looked at before starting this activity? (Answer: The yeast must have made the difference.)
  – Do you think that there is a chemical reaction taking place in the yeast? Why? (Answer: Yes. The bubbles show that a gas (carbon dioxide) has been produced.)
- You could make the connection to different ethnic groups and the types of breads that are a part of each culture. Consider having students bring in samples of different breads as part of a celebration at the end of this activity. Of course, students cannot eat anything in the science lab, so book the foods lab or cafeteria. Be aware that some students may have allergies to wheat or other ingredients. Those students could be challenged to bring some other example of a cultural food that shows evidence of a chemical change.

Test It! Activity (page 260)

Plan Your Own Investigation

Purpose

- Students design an investigation to determine how changing one variable (the manipulated variable) will affect the amount of carbon dioxide produced (the responding variable).

Science Background

During cellular respiration, organisms break down carbohydrates to release energy. The pathway that cellular respiration takes depends on the availability of oxygen. For example, if oxygen is present, then yeast will use aerobic cellular respiration to produce energy. The complete oxidation of glucose in aerobic cellular respiration is summarized by the following equation:

glucose + oxygen → carbon dioxide + water + energy

In the absence of oxygen, yeast will respire anaerobically and produce ethanol and carbon dioxide. This is inefficient (ultimately the ethanol will kill the yeast), but fermentation enables the yeast to survive and grow where no oxygen is available. The alcohol evaporates during the baking process.

Aerobic cellular respiration is more efficient. Yeast metabolism is determined in part by the temperature of the surrounding environment, so aerobic cellular respiration in yeast is particularly sensitive to temperature.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	• Gather materials.
Day of	• Set out materials.

APPARATUS	MATERIALS
For each group: • mixing bowl or beaker • measuring cup • measuring spoon • 3 – 1 L plastic pop bottles • 3 balloons • flexible tape measure (optional)	For each group: • white sugar • active dry yeast • string or tape

Suggested Timing

15 min to plan activity
15 min to set up activity
5 min each hour for the next several hours to record observations

Safety Precautions

- Remind students never to eat anything that has been made in a science room.
- Demonstrate the proper method of smelling any type of chemical or chemical reaction. You do not want students to put their face close to the beaker of yeast. Instead, you want them to keep their face away from the beaker and use their hand to "wave" the fumes toward their nose.

Activity Planning Notes

Place students in teams of three. One student can be responsible for gathering the materials and coordinating the set-up, one student responsible for timing, and the third student responsible for recording observations.

Remind students of the principles of a fair test. Specifically, make sure that they only change one variable in their investigation and that all other variables are kept the same.

If you want to bring some math into this activity, provide students with a flexible tape measure and have them measure and record the diameter of the balloon each time they make their observations. This will make this investigation more quantitative.

It might be easier if, as a class, you decided on the one variable that students will change. In other words, all of the students might want to increase the amount of yeast that they add to each bottle. This would provide a larger, more reliable pool of data that you can use for a follow-up discussion.

You may want to get your students to make a prediction. An easy way to help them make their prediction is to use an "if then" statement. For example, "If I add more yeast to the solution, then more carbon dioxide will be produced and the balloon will be bigger."

Make sure that students have stretched out the balloons (or blown them up) to make it easier for the plastic to expand as carbon dioxide is produced.

Accommodations

- Assign individual students into teams to make sure that the groups will work together throughout this activity.
- If you have many students who have problems reading or following written directions, you might want to do this investigation as a class demonstration. You can use the POE model of demonstrations.
  Predict: You pre-determine the manipulated variable that you want to change and have your students predict what will happen to the responding variable.
  Observe: Have students record their observations.
  Evaluate: Have students evaluate the activity. In this case, you might want them to complete What Did You Discover? questions 14 to 18 on page 264.

Test It! Answers (pages 260–264)

1. Students should choose one of the variables listed to manipulate, and list the remaining variables as controlled variables. For example, if temperature of the water is manipulated, then the controlled variables should be temperature surrounding the container, amount of yeast, amount of sugar, amount of water, and type of sugar.
2. Students' questions should be based on the variable they will manipulate. If the temperature of the water is being manipulated then the question might be, "How does the temperature of the water affect the growth of yeast?" or "Does yeast grow better with hot water, room temperature water, or cold water?"
3. Students state a prediction, such as "I predict that the yeast will grow better with hot water."
4. Students should measure and record the changes in the mixture. Sample answer:

Mixture	Change You Will Make
Test 2	• use cold water (20°C)
Test 3	• use hot water (80°C)

11. Students should have observed bubbles of carbon dioxide gas in Test 1, and in either, both, or neither of Tests 2 and 3.
12. The bottle with the most carbon dioxide produced will have the strongest smell. This bottle will also have the least amount of oxygen and the yeast will be fermenting the sugar (converting it into alcohol).
13. The balloons will inflate to varying amounts depending on the amount of carbon dioxide produced.
14. **a)** and **b)** Students should base their answers on which balloons inflated the most.
15. Accept a variety of reasonable answers. Some students may think that the more carbon dioxide produced, the better (lighter) the bread. They might like to revisit this answer after considering their answer to question 16.
16. Accept a variety of reasonable answers. Based on the smell of the bottles, students should be able to infer that the bread would smell and taste too much like yeast.
17. Students should be able to state that their investigation was a fair test because they manipulated only one variable and controlled the other variables.

18. Students' answers should be based on their results. For example, if neither very hot nor very cold water produced any yeast growth, a student could repeat the experiment using warm and cool water.

19. Students could choose to manipulate a different variable or collect data over a longer period of time.

Activity Wrap-up

- If each group chose its own variable to manipulate, you might want to ask each group to do a short presentation to the rest of the class. The presentation should include
  – the variable that they manipulated
  – what happened to the responding variable
  – what variables they controlled to ensure that they conducted a fair test
- If you have access to a bread maker in the foods lab or cafeteria, it might be fun for students to make a loaf of bread. This process will help them make the connection between the investigation and real life. Please make sure that you are aware of any health conditions such as celiac disease. Remember, do not use the science lab to prepare food that will be eaten.

Alternative Activities

- If you have not already done so, consider doing one or more of the demonstrations described in the Chapter 14 opening Activity Planning Notes.
- Students can design an activity in which they compare the effects of temperature on the chemical reaction that takes place inside a Light Stick™. These are available at many sporting goods stores, camping supply stores, and hardware stores. In most chemical reactions, if light energy is produced then thermal energy will also be produced. However, the chemical reaction that takes place in a Light Stick™ is an example of light energy being produced without thermal energy. Chemical reactions that produce light without heat are called chemiluminescent reactions.
- Use some or all of the activities in the following Chemistry *ActiveFolders*: Chemical and Physical Changes, and Chemical Reactions.

Ongoing Assessment

- Have your students complete questions 14 to 19 in the student resource. Collect and mark their answers to these questions.

Technology Links

For an activity that investigates the effect of temperature changes on the intensity of light produced by a Light Stick™, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Light Sticks.

14.2 Chemical Changes with Acids and Bases (page 265)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
15 min for introduction 45 min for Test It! 45 min for Try This!	• baking soda • 35 mm film canister with tight-fitting lid • vinegar • plastic sheet • baking powder • large watch glass or small beaker • water	OHT D–2 What Did You Observe? Assessment Master 3 Lab Report Checklist Assessment Master 4 Lab Report Rubric

Specific Expectations

CPM2.01 – plan and conduct investigations on the physical and chemical properties of substances, using lab equipment and materials safely and accurately
CPM2.02 – use appropriate laboratory safety and disposal procedures while conducting investigations
CPM2.03 – organize and record the observations of the investigations, using appropriate formats
CPM2.04 – interpret and communicate the results of investigations
SIL2.03 – conduct investigations safely, using appropriate lab equipment
SIL2.04 – observe and record data, using a variety of formats, including the use of SI units, where appropriate
SIL2.05 – assess data to make inferences and conclusions and to answer questions and refine procedures
SIL2.06 – communicate plans, observations, and results using a variety of oral, written, and graphic representations, and including the use of SI units, where appropriate

Key Terms Teaching Strategies

A fun way to reinforce the idea of a raising agent is an activity called the Film Canister Rocket. This activity is a bit messy but it not only demonstrates the idea of a raising agent, but also can be used to review the evidence of a chemical reaction from earlier in this chapter.

Make sure that students are a safe distance away and are wearing safety goggles. Add approximately 5 mL of baking soda to a 35 mm film canister. Add approximately 5 mL of vinegar to the film canister. Snap the lid on tightly and shake. Place the canister, lid side down, on a large piece of plastic. The pressure of the carbon dioxide produced by the chemical reaction will build up until it shoots the canister into the air. Discuss how this chemical reaction demonstrates the meaning of "raising agent."

Reading Icon Answers (page 265)

1. Students should highlight yeast and baking powder.
2. Students should highlight cream of tartar.

Activity Planning Notes

The paragraph before the Check Your Understanding questions may be confusing for some students. The following demonstration connects that paragraph to a real-life example.

Place 15 mL of baking powder in a large watch glass or small beaker. Ask students to describe the appearance of this chemical compound. Add 5 mL of water to the baking powder and ask students to describe their observations. Ask students to write their observations next to the illustration of baking powder on page 265 of their student resource.

Technology Links

- For more information on cream of tartar, go to **www.mcgrawhill.ca/books/Se9** and follow the links to What and Where Is Cream of Tartar?
- For information that compares baking powder to baking soda, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Baking Powder vs. Baking Soda.

Accommodations

- Students who are visually impaired may be able to hear the "fizzing" reaction as water is added to the baking powder.

Check Your Understanding Answers (page 265)

3. Use as a raising agent in baking.

4. Keeps the acid (cream of tartar) and the base (baking soda) separated and absorbs any moisture.

Making Connections Answer (page 265)

5. It is a liquid, so it would react with the baking soda.

Test It! Activity (page 266)

Raising Agent Race

Purpose

- Students determine which chemical compound could be classified as the best raising agent.

Science Background

Baking soda, also known as sodium bicarbonate, does not react with water. Tartaric acid (cream of tartar) does not produce a visible reaction with water.

Baking powder is a mixture of tartaric acid (cream of tartar) and baking soda. When water is added to baking powder, the acid and bicarbonate combine to make a salt and carbonic acid. This is an example of an acid–base chemical reaction. The carbonic acid quickly decomposes to water and carbon dioxide gas. Carbon dioxide gas causes cakes to rise.

The egg white does not participate in the chemical reaction. It traps the carbon dioxide gas and produces the foaming action that students will observe.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days	• Gather materials.
1 day before	• Organize the apparatus and materials. Put materials into small containers, one container per group. • Photocopy **Assessment Master 3 Lab Report Checklist** and **Assessment Master 4 Lab Report Rubric**.

APPARATUS	MATERIALS
For each group: • markers • 3 – 250 mL graduated cylinders • timers	For each group: • masking tape • 5 mL baking soda • 5 mL cream of tartar • 5 mL baking powder • 1 egg white mixed with 200 mL cold water

Suggested Timing

10 min to set up the graduated cylinders
10 min for the reactions to take place
20 min to record observations, draw the graph, and answer questions
5 min to clean up

Safety Precautions

- Remind students never to eat anything that has been made in a science room.
- Remind students that they are working with acids and bases. Anytime they work with potentially corrosive chemicals, they must wear the proper safety equipment. It is imperative that they follow the procedure exactly as it is presented.
- Students should clean up their work area and wash their hands thoroughly at the end of the activity.

Activity Planning Notes

If you are going to do this as a class activity, you might want to

1. Pre-assign your groups into teams of three students to save time.
2. Have all of the materials and equipment set out for the students. Consider organizing all of the materials in plastic containers. Set up one container for each group as follows:
   - 5 mL of baking soda in a labelled graduated cylinder
   - 5 mL of cream of tartar in a labelled graduated cylinder
   - 5 mL of baking powder in a labelled graduated cylinder
   - 25 mL of egg-white solution in three small beakers

Use the millilitre measurement scale on the side of the beaker to record the height of the foam.

You may also want to consider doing this investigation as a demonstration. In this case, you might want to use the POE method for scientific demonstrations.

- **P**redict: Before you start, ask the students to make a prediction. You could ask them to predict which graduated cylinder will produce the most foam.
- **O**bserve: Have your students fill in the table on page 266.
- **E**valuate: Have your students complete the graph and answer questions 8 and 9 on page 267.

Students will observe that very little reaction occurs in the baking soda and egg-white solution, nor is there much of a reaction with the cream of tartar and egg-white solution. However, the reaction in the baking powder and egg-white solution is immediate. The chemical reaction takes place very quickly and the foam starts to rise in the beaker.

Although the materials list in the student resource suggests using 250 mL measuring cylinders, the reaction is much more exciting (though messier) when you use 100 mL graduated cylinders (the baking powder mixture might overflow the cylinder).

You may wish to use **OHT D–2 What Did You Observe?** to help students complete their graphs. You will notice in the sample data that the height of the baking powder and egg-white solution did not change significantly after 3 min. The chemical reaction was completed within 2 min. In chemical terms, the reactants were used up. However, the egg whites acted like the meringue on the top of a lemon meringue pie, and the foam remained relatively intact for the remaining 7 min of the activity.

Accommodations

- Students with visual difficulties can use their sense of touch to determine which mixture produced the most bubbles. The chemicals used in this investigation are common household chemicals and should not pose a problem as long as students wash their hands thoroughly after touching the reactants.

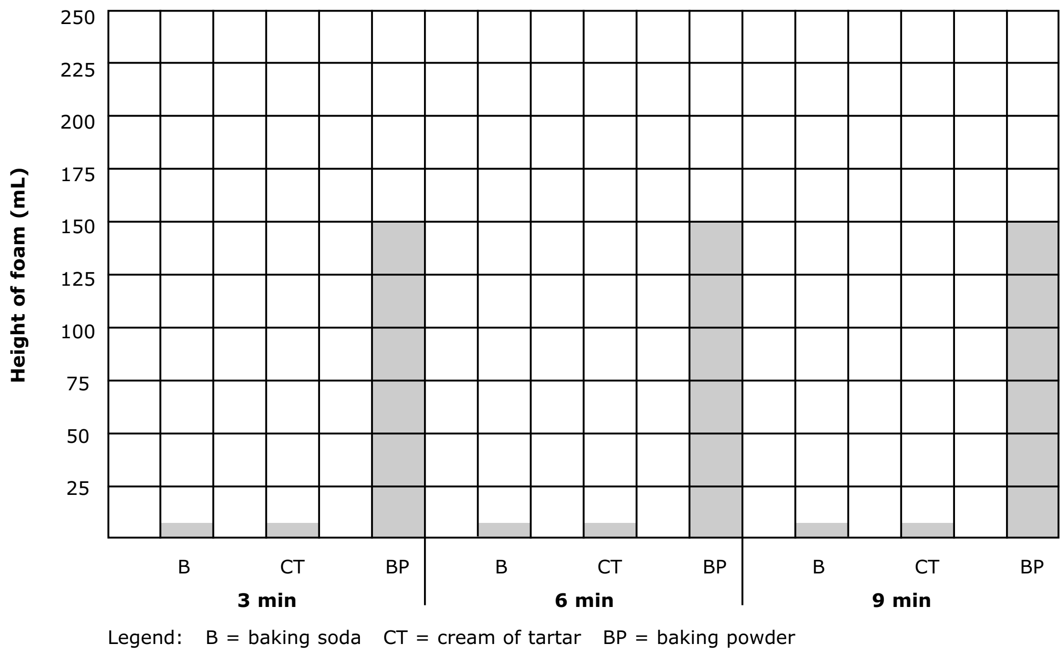
What to Do Answer (page 266)

6. The data shown here were collected using a 250 mL beaker as the measuring cylinder.

Time (min)	Baking Soda	Cream of Tartar	Baking Powder
3	1 mL	1 mL	150 mL
6	1 mL	1 mL	150 mL
9	1 mL	1 mL	125 mL

What Did You Observe? Answers (page 267)

7.



8. **a)** baking powder

   b) Baking powder was the only raising agent that produced any foam.

9. Baking powder was the only raising agent that produced any foam.

Activity Wrap-up

- End this activity with a discussion of other types of foods that might contain raising agents. If available in your school, work with the foods and nutrition teacher. Have students read the food labels of packaged foods such as cakes, cookies, or pancakes to see if they can find the name of the raising agent(s) used in these products.
- Have students complete **Assessment Master 3 Lab Report Checklist**.

Try This! Activity (page 267)

Purpose

- Students determine which chemical compound could be classified as the best raising agent.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	• Gather materials.
1 day before	• Organize the apparatus and materials. Place all the materials students need into small containers, one container per group. • Photocopy pages 266 and 267 and make an overhead projection.

APPARATUS	MATERIALS
For each group: • marker • 3 – 250 mL graduated cylinders • timer	For each group: • masking tape • 5 mL baking soda • 5 mL cream of tartar • 5 mL baking powder • 200 mL cold water

Suggested Timing

10 min to set up the graduated cylinders
10 min for the reactions to take place
20 min to record observations, draw the graph, and answer questions
5 min to clean up

Safety Precautions

- Remind students never to eat anything that has been made in a science room.
- Students should clean up their work area and wash their hands thoroughly at the end of the activity.

Activity Planning Notes

Set up one container for each group as follows:

- 5 mL of baking soda in one graduated cylinder
- 5 mL of cream of tartar in a second graduated cylinder
- 5 mL of baking powder in a third graduated cylinder
- 25 mL of water in 3 small beakers (do not use an egg-white mixture)

You may also want to consider doing this as a demonstration. In this case, you might want to use the POE method for scientific demonstrations.
Predict: Before you start, ask the students to make a prediction. You could ask the students to predict which graduated cylinder will produce the most foam.
Observe: Have your students fill in the table on the photocopied page 266.
Evaluate: Have your students draw a graph similar to the one for question 7 on page 267, and have them answer questions 8 and 9 on the photocopied page 267.

The students will notice that baking soda and cream of tartar do not produce a visible chemical reaction with water. If you use water in this activity, you will basically have the same results as you did in the previous one. The only significant difference is that the foam in the baking powder gradually disappears over the course of the 9 min.

Accommodations

- Students with visual difficulties can use their sense of touch to determine which mixture produced the most bubbles. The chemicals used in this investigation are common household chemicals and should not pose a problem as long as students wash their hands after handling the reactants.

Activity Wrap-up

Have students compare the results of the two investigations. Ask them to infer the role that the egg white played in the investigation.

Alternative Activities

- Substitute vinegar for water without telling the students. Have your students make a prediction. Based on their previous experience, they may predict that they will only get a chemical reaction with the baking powder and water. However, if you use vinegar instead, you will get a very rapid reaction between the baking soda (which is a base) and with vinegar (an acid). This switch should open the door for a discussion about safe handling of chemicals. For example, you can point out that water and an acid look the same but have different properties.
- Use all or some of the activities in the following Chemistry *ActiveFolders*: Acids and Bases.

Ongoing Assessment

- Use **Assessment Master 4 Lab Report Rubric** to assess student reports for the Test It! Raising Agent Race.
- Ask your students the following questions to check their understanding of this section. This could take the form of a question and answer session in class.
  1. What is an example of a raising agent that is used in baking?
  2. Why do bakers use raising agents when they are making cookies?
  3. What would happen to a cake if you forgot to add the raising agent?

Technology Links

For a variety of "kitchen science" activities, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Kitchen Chemistry.

Chapter 14 Review (page 268)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
45 min to complete and take up the review, and then assign Practice Test	• 5 mL table salt • 250 mL water • disposable coffee stir sticks (1 per student) • 50 mL heatproof beaker • electric hot plate	Master 3 Certificate Master 4 List of Skills BLM 14–2 Chapter 14 Practice Test BLM 14–3 Chapter 14 Test

Using the Chapter Review

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

Once the review is completed and assessed, assign **BLM 14–2 Chapter 14 Practice Test** for students to answer individually. They may wish to use their completed review to help them.

Students may be confused by question 3 a). “Dissolving salt in water is an example of a chemical change” is a false statement. Here is an advanced explanation of what happens when you dissolve salt in water:

- Dissolving table salt in water is a physical change because only the state of the matter has changed. Physical changes can often be reversed. Allowing the water to evaporate will return the salt to a solid state. Although the salt may not recrystallize into the same uniform crystals you started with, it is still salt. When salt is dissolved in water, the water tastes salty because the salt is still there. It has not combined with the water to cause a chemical reaction (a new substance has not formed).
- You can demonstrate this by dissolving 5 mL of salt in 250 mL of water. You could have students dip a coffee stir stick into the solution, “taste” a very small quantity, and then dispose of the stir sticks. Then you can pour a small amount of salt water into a heatproof beaker and place the beaker on a hot plate to speed up the evaporation of the water. The residue in the beaker is the original salt.

Review Guide

Question	Section(s)	Refer to
1	14.2	Chemical Changes with Acids and Bases (page 265)
2	Chapter Opener	Science in Cooking (page 258)
3 a)–d)	Chapter Opener	Science in Cooking (page 258)
3 e)	14.2	Chemical Changes with Acids and Bases (page 265)
4	Chapter Opener	Science in Cooking (page 258)
5	Chapter Opener	Science in Cooking (page 258)
6	14.1, 14.2	Science in Cooking (page 258), Test It! Plan Your Own Investigation (page 260), Chemical Changes with Acids and Bases (page 265)
7	14.2	Chemical Changes with Acids and Bases (page 265)
8	14.1	Test It! Plan Your Own Investigation (page 260)
9	whole chapter	

Accommodations

- Allow students to make a chapter summary page of the key ideas/skills from the chapter. The back of the student resource provides space to do this. Alternatively, you might develop a chapter summary as an entire class.
- If students have difficulty with a particular review question, use the Review Guide to identify the section they need to review.
- **BLM 14–2 Chapter 14 Practice Test** can be customized to produce extra reinforcement questions.

Summative Assessment

- Have students complete **BLM 14–3 Chapter 14 Test** to assess individual skills.
- You may wish to develop **Master 3 Certificate** to show students what they have learned during this chapter. Cut and paste the related skills from **Master 4 List of Skills**.

Chapter 14 Review Answers (pages 268–269)

1. **b)** raising agent
2. **a)** chemical change
3. **a)** F. Dissolving salt in water is not an example of a chemical change because there is no evidence of a chemical change. **Note:** See Using the Chapter Review above for an explanation and activity to demonstrate that dissolving salt in water is not a chemical change because it can be reversed.

   b) F. A chemical change cannot be reversed. **Note:** see Using the Chapter Review above for an explanation and activity to demonstrate that a physical change can be reversed.

   c) T

   d) F. Chemical change can also happen when foods are combined with other foods or other substances.

   e) T
4. Students should underline gas bubbles and changed into new substances.
5. No. Changing the oil means replacing the old oil with fresh oil.
6. **a)** Bread B

   b) The bread did not rise.

   c) Yes

   d) Bread B has a change in colour and the changes in Bread B cannot be reversed.
7. Student should circle baking powder and eggs.
8. It is important to record the exact amounts of ingredients you use when you test recipes because a slight change in the amount of an ingredient can change how the finished product looks and tastes.
9. Accept any reasonable explanation. Knowing about chemistry helps a baker to understand what will happen when certain ingredients are mixed. Chemistry also helps a baker because if you do not add the right amount of each ingredient, then your recipe is likely to fail.