

# Activity Preparation for Chapter 15

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
<i>What's Going On? Keep the Moisture In</i> (page 270) (TR page 332)	<ul style="list-style-type: none"> <li>• 2 days before                             <ul style="list-style-type: none"> <li>– Gather materials.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 15 min to set up</li> <li>• 5 min per day for 5 days</li> </ul>	<ul style="list-style-type: none"> <li>• Note that this activity requires students to make observations over 5 days.</li> </ul>
<i>Test It! Sunscreen Slices</i> (page 274) (TR page 336)	<ul style="list-style-type: none"> <li>• 1 to 2 days before                             <ul style="list-style-type: none"> <li>– Purchase apples.</li> <li>– Gather materials and photocopy any assessment masters you decide to use.</li> </ul> </li> <li>• 1 hour before                             <ul style="list-style-type: none"> <li>– Core and slice the apples (optional).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 20–30 min to set up</li> <li>• 5 min per day for next 3 days</li> <li>• 15 min for What Did You Discover?</li> </ul>	<ul style="list-style-type: none"> <li>• Note that this investigation requires students to make observations over 3 days.</li> <li>• To save time, core and slice the apples ahead of time. Try to use apple rings that are approximately the same diameter from the same type of apples.</li> </ul>
<i>Try This!</i> (page 276) (TR page 338)	<ul style="list-style-type: none"> <li>• Day 4 of Test It! Sunscreen Slices                             <ul style="list-style-type: none"> <li>– Have students return the apple slices to the drying location.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 5 min per day for 3–4 days</li> </ul>	<ul style="list-style-type: none"> <li>• Note that this investigation requires students to make observations over a 3-day period.</li> </ul>
<i>Test It! Test Your Toothpaste</i> (page 278) (TR page 342)	<ul style="list-style-type: none"> <li>• 3 to 4 days before                             <ul style="list-style-type: none"> <li>– Make sure you have all of the ingredients for the homemade toothpaste.</li> <li>– Purchase tube of commercial toothpaste.</li> <li>– Purchase toothbrushes.</li> <li>– Purchase and hard boil the eggs.</li> <li>– If you are not using brown eggs, stain the hard-boiled eggs in tea or a commercially available egg colouring kit.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 25 min to plan</li> <li>• 25 min to conduct</li> </ul>	<ul style="list-style-type: none"> <li>• Using brown eggs can save the time required to stain the hard-boiled egg. If you wish to eliminate Step 3 in the What to Do section of this activity (students choosing their own staining method), you can soak the eggs in tea or commercially available egg colouring dyes ahead of time.</li> </ul>
<i>Try This!</i> (page 281) (TR page 344)	<ul style="list-style-type: none"> <li>• 2 or 3 days before                             <ul style="list-style-type: none"> <li>– Purchase and hard boil the brown eggs.</li> <li>– Purchase tooth whitening strips and/or paste.</li> </ul> </li> <li>• 1 day before                             <ul style="list-style-type: none"> <li>– Photocopy <b>BLM 15–5 Are All Tooth Whiteners the Same?</b> and any assessment masters you decide to use.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 25 min to plan</li> <li>• 10 min to apply the tooth whiteners</li> <li>• 7 min per day for 3 days to change the whitening strips and record observations</li> </ul>	<ul style="list-style-type: none"> <li>• Consider doing this activity as a demonstration for your students. This will save on the cost of whitening strips.</li> <li>• Note that this activity requires students to make observations over 3 days.</li> </ul>

# Materials Needed for Chapter 15

Activity/Investigation	Apparatus	Materials	Blackline Masters
<i>What's Going On? Keep the Moisture In</i> (page 270) (TR page 332)	For each group: <ul style="list-style-type: none"> <li>• marker</li> <li>• 2 – 500 mL beakers</li> <li>• clear plastic rulers</li> </ul>	For each group: <ul style="list-style-type: none"> <li>• masking tape</li> <li>• water</li> <li>• cooking oil</li> </ul>	
<i>Test It! Sunscreen Slices</i> (page 274) (TR page 336)	For each group: <ul style="list-style-type: none"> <li>• paring knife</li> <li>• marker</li> <li>• ruler</li> <li>• scissors</li> <li>• coat hanger</li> </ul>	For each group: <ul style="list-style-type: none"> <li>• apple</li> <li>• scrap paper or cardboard</li> <li>• cooking oil</li> <li>• sunscreen</li> <li>• tanning product (students' choice)</li> <li>• string</li> <li>• cheesecloth (optional)</li> <li>• lemon juice (optional)</li> <li>• water (optional)</li> </ul>	<b>Optional</b> Assessment Master 1 Co-operative Group Work Checklist Assessment Master 2 Co-operative Group Work Rubric Assessment Master 3 Lab Report Checklist Assessment Master 4 Lab Report Rubric
<i>Try This!</i> (page 276) (TR page 338)		For each group: <ul style="list-style-type: none"> <li>• the hanger with the apple rings from Test It! Sunscreen Slices</li> </ul>	
<i>Test It! Test Your Toothpaste</i> (page 278) (TR page 342)	For each group: <ul style="list-style-type: none"> <li>• 250 mL beaker</li> <li>• medicine dropper</li> <li>• toothbrush</li> <li>• marker</li> </ul>	For each group: <ul style="list-style-type: none"> <li>• baking soda</li> <li>• salt</li> <li>• glycerin</li> <li>• stir stick or spoon</li> <li>• water</li> <li>• pH paper</li> <li>• hard-boiled egg</li> <li>• commercial toothpaste</li> <li>• stain for egg (if not using brown eggs)</li> </ul>	
<i>Try This!</i> (page 281) (TR page 344)	For each group: <ul style="list-style-type: none"> <li>• permanent marker</li> </ul>	For each group: <ul style="list-style-type: none"> <li>• brown hard-boiled egg</li> <li>• tooth whitener strips or paste</li> </ul>	<b>Recommended</b> BLM 15–5 Are All Tooth Whiteners the Same? <b>Optional</b> Assessment Master 1 Co-operative Group Work Checklist Assessment Master 2 Co-operative Group Work Rubric Assessment Master 13 Fair Test Checklist Assessment Master 14 Fair Test Rubric

# CHAPTER 15 The Science of Looking Good (page 270)

<b>SUGGESTED TIMING</b> 25 min 15 min to set up What's Going On?; 5 min per day for 5 days for observations	<b>MATERIALS</b> • household magazines	<b>BLACKLINE MASTERS</b> Master 1 Centimetre Grid Paper BLM 15–1 Personal Care Product Survey
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## 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

You might use **BLM 15–1 Personal Care Product Survey**, a short activity designed to reinforce the introductory sentence that consumers spend billions of dollars on personal care products each year. Photocopy and distribute the blackline master. Review the instructions for this activity and show students how to fill in their tick marks to make a tally chart. When students have completed their surveys, have them total the number of tick marks in each column and answer the two questions on the blackline master. If time permits, have the students draw a bar graph of the data using **Master 1 Centimetre Grid Paper**. Ask students why they think there are so many personal care advertisements in magazines.

Note that the What's Going On? activity on page 270 requires students to make observations over five days, and the Test It! investigation on pages 274 to 276 requires students to make observations over a three-day period.

**What's Going On?** (page 270)

*Keep the Moisture In*

**Purpose**

- Students observe the effect a layer of oil has on the evaporation of water.

**Advance Preparation**

WHEN TO BEGIN	WHAT TO DO
2 days before	• Gather materials.

APPARATUS	MATERIALS
For each group: • markers • 2 – 500 mL beakers • clear plastic rulers	For each group: • masking tape • water • cooking oil

**Suggested Timing**

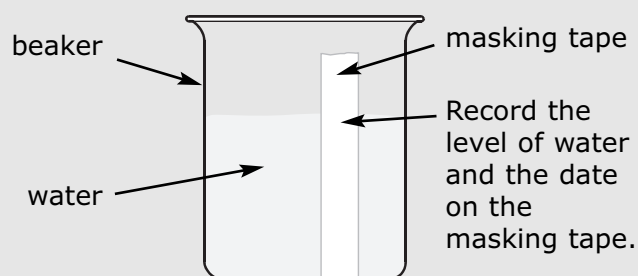
15 min to set up activity  
5 min per day for 5 days

### Safety Precautions

- Remind students to wipe up any spilled liquid.
- Remind students that oil could stain clothing.
- Have students clean up the work area and wash their hands when they have completed this activity.

### Activity Planning Notes

Have students place the masking tape on the beaker vertically. Your students can use a small mark and then record the date on the masking tape to record the daily level of water in each beaker.



Students should measure the water level in Beaker B, not the level of the water plus the oil.

Some of the water in Beaker A will evaporate over the course of five days. This will reduce the volume of water in that beaker. In Beaker B, the layer of oil will float on top of the water. This will reduce the amount of water that evaporates from this beaker.

### Accommodations

- Students with visual disabilities should be paired with students without this impairment. The visually impaired students may be able to use their sense of touch to gain a better understanding of what is happening in this activity.
- Students with fine motor disabilities may need some help recording the water levels on the masking tape.

#### What to Do Answer (page 270)

4. Results will vary slightly, but should show that the water in Beaker A evaporated at a faster rate than the water in Beaker B.

#### What Did You Learn? Answers (page 270)

5. There is a difference in water level between the two beakers because the water molecules could not pass through the layer of oil in Beaker B to evaporate.
6. When you apply skin cream, you are applying a layer of oil to the surface of the skin, which slows down evaporation so the skin stays moister for a longer period of time.

### Activity Wrap-up

- Ask students to list other ways that we try to prevent the evaporation of water. For example, fresh produce and bread are packaged in plastic bags.

# 15.1 The Science of Skin (page 271)

## SUGGESTED TIMING

45 min  
20–30 min to set up Test It!; 5 min per day for 3 days of observations; 15 min for What Did You Discover?  
5 min for each of 3–4 days for Try This! observations

## MATERIALS

- recipe cards or slips of paper

## BLACKLINE MASTERS

Master 1 Centimetre Grid Paper  
BLM 15–2 Looking at Skin  
BLM 15–3 Designer Hand Cream  
OHT D–3 How Do Skin Creams Work?  
Assessment Master 1 Co-operative Group Work Checklist  
Assessment Master 2 Co-operative Group Work Rubric  
Assessment Master 3 Lab Report Checklist  
Assessment Master 4 Lab Report Rubric

## Specific Expectations

- CPM1.04** – describe the physical properties of common materials, using appropriate scientific terminology  
**CPM1.05** – describe the chemical properties of common materials, using appropriate scientific terminology  
**CPM2.01** – plan and conduct investigations on the physical and chemical properties of substances, using lab equipment and materials safely and accurately  
**CPM2.03** – organize and record the observations of the investigations, using appropriate formats  
**CPM2.04** – interpret and communicate the results of investigations  
**CPM3.01** – investigate the physical and chemical properties of the component materials of two similar products  
**CPM3.02** – compare the physical and chemical properties of the materials investigated and relate these properties to how they are used  
**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

## Key Terms Teaching Strategies

A fun way to set the stage for the key terms in Section 15.1 is to come to the class wearing some type of beach wear that includes a wide-brimmed hat, zinc oxide on your nose, UV sunglasses, and a bottle of chemical sunscreen in a pocket or bag. Use the following props to help your students make the connection between your apparel and the key terms:

- a black light to demonstrate ultraviolet radiation;
- zinc oxide to demonstrate physical sunscreens; and
- commercial sunscreen to demonstrate chemical sunscreens.

Have students make a poster that includes a person wearing a wide-brimmed hat and sunscreen. The poster should include the Sun and represent ultraviolet radiation striking the person.

### Reading Icon Answers (page 272)

1. Expect students to highlight that the water in Beaker B did not evaporate because it could not pass through the layer of oil.
2. Students should underline Sun, wind, and washing.

### Reading Icon Answers (page 273)

6. Expect students to highlight ultraviolet rays.
7. Expect students to circle physical sunscreens and chemical sunscreens.
8. Students should underline Sun protection factor.

## Activity Planning Notes

**BLM 15–2 Looking at Skin** provides a short activity that allows students to look at their skin using a hand lens or a dissecting microscope. You might wish to use this blackline master after page 271.

Use **OHT D–3 How Do Skin Creams Work?** with page 272 to reinforce what students observed in the What's Going On? activity on page 270.

**BLM 15–3 Designer Hand Cream** provides students with an opportunity to make their own hand cream. You might wish to use this blackline master after page 272.

Discuss students' prior knowledge and experience of suntanning. You may wish to invite a dermatologist to come into your class to discuss the dangers associated with tanning.

Show students how to calculate the effectiveness of chemical sunscreens on page 273.

Consider using the following blackline masters and overhead transparency:

- **Master 1 Centimetre Grid Paper**
- **BLM 15–2 Looking at Skin**
- **BLM 15–3 Designer Hand Cream**
- **OHT D–3 How Do Skin Creams Work?**

### Accommodations

- To help students with the Making Connections feature on page 271, cut a piece of paper into 100 squares and then remove 10 of them. You may wish to use **Master 1 Centimetre Grid Paper** for this purpose.
- There are three new terms introduced in this section. Students can make their own study aids by writing a brief illustrated story that includes all three definitions written in colour.

**Check Your Understanding Answers (page 271)**

1. Accept any reasonable tips. For example:
  - a) eat lots of fruit
  - b) eat lots of vegetables
  - c) drink lots of water

**Making Connections Answer (page 271)**

2. Students should shade in any ten of the squares of the hundred chart.

**Check Your Understanding Answers (page 272)**

3. A layer of oil holds in moisture by preventing water from evaporating.
4. Skin creams can help put moisture back into the skin and add a film of oil to the surface of the skin to help prevent evaporation.

**Making Connections Answer (page 272)**

5. The kind of skin cream that protects your skin from getting sunburn is called sunscreen or sunblock cream. Some students may have named actual brands of sunscreen.

**Check Your Understanding Answers (page 273)**

9. A physical sunscreen protects the skin by reflecting the ultraviolet rays. A chemical sunscreen protects the skin by absorbing the ultraviolet rays.
10.  $20 \text{ min} \times 30 \text{ SPF} = 600 \text{ min}$

**Making Connections Answer (page 273)**

11. It is recommended to apply sunscreen about half an hour before going out in the Sun so that the skin has a chance to absorb the lotion in order to be protected.

**Test It! Activity (page 274)**

*Sunscreen Slices*

**Purpose**

- Students observe how different products reduce the loss of water due to evaporation.

**Science Background**

Solar radiation includes visible light and other wavelengths that are invisible to the human eye, such as ultraviolet (UV) rays and infrared (heat) waves. Exposure to UV radiation at high doses increases the risk of developing skin cancer.

The unprotected apple rings will dry out in two to three days when exposed to solar radiation.

**Advance Preparation**

WHEN TO BEGIN	WHAT TO DO
1 to 2 days before	<ul style="list-style-type: none"> <li>• Purchase apples.</li> <li>• Gather materials.</li> </ul>
1 hour before	<ul style="list-style-type: none"> <li>• Core and slice the apples (optional).</li> </ul>

APPARATUS	MATERIALS
For each group: <ul style="list-style-type: none"> <li>• paring knife</li> <li>• ruler</li> <li>• marker</li> <li>• scissors</li> <li>• coat hanger</li> </ul>	For each group: <ul style="list-style-type: none"> <li>• apple</li> <li>• scrap paper or cardboard</li> <li>• cooking oil</li> <li>• sunscreen</li> <li>• tanning product (students' choice)</li> <li>• string</li> <li>• cheesecloth (optional)</li> <li>• lemon juice (optional)</li> <li>• water (optional)</li> </ul>

### Suggested Timing

- 20–30 min to set up
- 5 min per day over the next 3 days for recording observations
- 15 min for What Did You Discover?

### Safety Precautions

- Ensure students are careful using the knife. Discuss how sharp objects such as knives and scissors should be held and carried. You may wish to slice the apples for the students.
- Remind students to keep sharp objects such as scissors and paring knives pointing down when held in hand and not in use.
- Review the rules about not eating anything in the science lab.
- Remind students that some sunscreens can discolour clothing.
- Students should clean up the work area and wash their hands thoroughly after completing this activity.

### Activity Planning Notes

To save time, core and slice the apples ahead of time. Try to use apple rings that are approximately the same diameter from the same type of apples.

Dip apple slices in an ascorbic acid mixture (60 mL of lemon juice to 1 L water) to keep them from turning brown as they dry.

This activity could be done as a teacher demonstration. Ask one or two students to help you set up the apple rings as shown on page 275. Invite other students to record the diameter of the apple rings over the next three days.

A clear, plastic ruler makes it easier to record the diameter of the rings. Students will likely have to wash the ruler after measuring the apple rings coated with sunscreen or oil.

Grouping students into teams of four can save time and apples. Each student can prepare one of the apple slices.

Before coating the apple slices, have students trace an outline of the apple rings on a piece of paper or cardboard. Make sure that they record the coating used on each paper ring. At the end of the activity, the students can lay their dried apple rings back on the paper rings as a comparison.

Stress the importance of controlling variables such as the thickness and diameter of the apple slices and the thickness of the coatings applied to the apple slices.

### Accommodations

- Students with physical disabilities can be teamed with students who can do this investigation.
- Students could use their sense of touch to compare the diameter of the apple slices at the end of the activity to the cardboard cut-out of the apple slices made at the start of the activity.

### Test It! Answers (pages 274–276)

1. Accept all reasonable questions. Sample question: Which coating best protects the apple rings from drying out?
2. Sample answer: I think the apple rings with the sunscreen and the oil will stay the same and the ones without coating will shrink.
3. Manipulated variable: coating on the rings  
Responding variable: size of the apple rings  
Controlled variables: amount of sunlight; size of rings; type of apple used; and length of time the rings were left
12. The uncoated apple will dry out the most. The diameter of this apple slice will be much smaller after three days. The diameters of the other apple slices may or may not change depending on the products used to coat them and the thickness of the coating applied to the slices.
13. It was important to have one ring that was not coated so that it could be a fair test to determine whether the sunscreen made a difference.
14. The number of the ring will vary, but students should be able to identify that the ring that lost the most moisture is the ring that has shrunk the most. This will likely be the apple that was left unprotected.



- 15. The material will vary, but students should identify the evidence of which ring retained the most moisture. Students may find that an oil-based tanning lotion and the cooking oil provided the same degree of protection.
- 16. The same amount of tanning product might not have been applied equally to the slices. Some of the rings may have received more or less direct Sun than other rings. The rings might have been of different thickness, or have come from different apples with varying amounts of moisture.

- 17. Student predictions will depend on the coatings used. Students may predict that the uncoated apple will shrink even more if it is left for a week. However, this apple ring may have already lost most of its moisture and might not shrink any further.

### Activity Wrap-up

- Have students draw an apple slice before and after it has dried out. Students can use arrows to show that water has evaporated from the apple slice.
- Compare the results of this activity with the results of the What’s Going On? activity on page 270. You may wish to have students complete **Assessment Master 3 Lab Report Checklist**. If students worked in groups for the investigation, you might use **Assessment Master 1 Co-operative Group Work Checklist**.

### Try This! (page 276)

#### Purpose

- Students continue to observe apple slices from the Test It! activity on pages 274 to 276.

#### Science Background

The diameter of the uncoated apple slice should not change appreciably with the added time. An uncoated apple will have lost most of its moisture in the first three days and the additional time will not affect the diameter of the apple slice.

The coatings applied may dry out or break down with the additional time. The diameter of these apple slices could change with the additional time.

### Advance Preparation

WHEN TO BEGIN	WHAT TO DO
Day 4 of Test It! Sunscreen Slices	<ul style="list-style-type: none"> <li>• Have students return the apple slices to the drying location.</li> </ul>

APPARATUS	MATERIALS
	For each group: <ul style="list-style-type: none"> <li>• the hanger with the apple rings from Test It! Sunscreen Slices</li> </ul>

### Suggested Timing

5 min per day for next 3–4 days

### Safety Precaution

- Have students wash their hands thoroughly after recording their observations.

### Activity Planning Notes

This is a continuation of the Test It! activity. Have students make a data collection chart similar to the one shown on page 275 to record their observations.

### Accommodations

- Students with physical disabilities can be teamed with students who can do this activity.
- Students could use their sense of touch to compare the diameter of the apple slices at the end of the activity to the cardboard cut-out of the apple slices made at the start of the activity.

### Activity Wrap-up

- Have students compare their final observations to their predictions.
- Ask students, “Did the diameters of your apple slices change even with the additional time?” Then ask them to come up with a possible explanation.

## Alternative Activity

- If you have access to a foods lab or kitchen, students can dry apple slices in a dehydrator or oven and then snack on them.

### Ongoing Assessment

- Collect and mark student answers to the What Did You Discover? questions on page 276.
- You may wish to use **Assessment Master 4 Lab Report Rubric** and/or **Assessment Master 2 Co-operative Group Work Rubric**.
- Have your students make an “Exit Card.” An Exit Card is an easy, 5 min activity to check student knowledge at the conclusion of this section. Students respond to three questions and write their answers on a recipe card or slip of paper. You can quickly read the responses and plan necessary instruction. Possible questions for the Exit Cards include
  1. What are two things that skin creams do?
  2. Why is it important for you to apply sunscreen to your skin before going to the lake on a sunny day?
  3. What are three functions of your skin?

### Technology Links

- For more information on protecting the skin from ultraviolet rays, go to [www.mcgrawhill.ca/books/Se9](http://www.mcgrawhill.ca/books/Se9) and follow the links to Sun and Skin.

# 15.2 How Do Toothpastes Work?

(page 277)

## SUGGESTED TIMING

25 min for introduction  
 25 min to plan Test It!; 25 min to conduct  
 15 min to discuss Right about White? on page 281  
 35 min to conduct Try This!;  
 7 min per day for 3 days for observations

## BLACKLINE MASTERS

BLM 15–4 What Is in Toothpaste?  
 BLM 15–5 Are All Tooth Whiteners the Same?  
 OHT D–4 Toothpaste Ingredients  
 Assessment Master 1 Co-operative Group Work Checklist  
 Assessment Master 2 Co-operative Group Work Rubric  
 Assessment Master 13 Fair Test Checklist  
 Assessment Master 14 Fair Test Checklist

## Specific Expectations

- CPM1.04** – describe the physical properties of common materials, using appropriate scientific terminology  
**CPM1.05** – describe the chemical properties of common materials, using appropriate scientific terminology  
**CPM2.01** – plan and conduct investigations on the physical and chemical properties of substances, using lab equipment and materials safely and accurately  
**CPM2.03** – organize and record the observations of the investigations, using appropriate formats  
**CPM2.04** – interpret and communicate the results of investigations  
**CPM3.01** – investigate the physical and chemical properties of the component materials of two similar products  
**CPM3.02** – compare the physical and chemical properties of the materials investigated and relate these properties to how they are used  
**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

### Technology Links

- For more information on plaque, go to [www.mcgrawhill.ca/books/Se9](http://www.mcgrawhill.ca/books/Se9) and follow the links to Tooth Decay.

### Key Terms Teaching Strategies

The key term in this section is plaque. Use images available on the Internet to show students examples of plaque and how it can damage teeth and gums.

**Reading Icon Answer (page 277)**

strengthen teeth.

1. Expect students to highlight scrub away plaque; slow down the growth of plaque bacteria; and

**Activity Planning Notes**

Photocopy and distribute **BLM 15–4 What Is in Toothpaste?** to your students. Use this in conjunction with **OHT D–4 Toothpaste Ingredients** to help your students complete the Making Connections chart on page 277.

Once students have completed the Test It! on pages 278–280, have them read and discuss the Science and Literacy Link on page 281. This activity can be linked to the Activity Wrap-up suggested for the Test It! You could also use this activity to talk about Consumer Reports and the importance of being an informed consumer.

Use the following blackline masters and overhead transparency:

- **BLM 15–4 What Is in Toothpaste?**
- **BLM 15–5 Are All Tooth Whiteners the Same?**
- **OHT D–4 Toothpaste Ingredients**

**Making Connections Answer (page 277)**

2. Answers will vary according to the brand of toothpaste used. Sample answer:
  - abrasive; dicalcium phosphate
  - fluoride; sodium monofluorophosphate
  - detergent; sodium laurel sulfate
  - humectant; sorbitol and glycerin
  - thickener; carboxymethylcellulose sodium
  - preservative; not listed
  - flavouring agent; flavours
  - colouring agent; not listed
  - sweetener; sodium saccharin

**Note:** Tetrasodium pyrophosphate (TSPP) is an ingredient listed in some brands of toothpaste. This ingredient removes calcium and magnesium from the saliva, so they cannot deposit on teeth as calcified plaque.

**Making Connections Answers (page 281)**

1. No. The eggs could have been different shades of brown before the test and the shells could have reacted differently to the strips. Some students might pick up the fact that there is a difference between the enamel in human teeth and the shell of an egg. To be accurate, testing should be done on human teeth.
2. Students might suggest applying both strips to the same egg. They might also suggest that the test strips should be changed according to the instructions on the package, such as applying a new whitener strip every day.

**Technology Links**

- For a toothpaste consumer review, go to [www.mcgrawhill.ca/books/Se9](http://www.mcgrawhill.ca/books/Se9) and follow the links to Consumer Review.

**Accommodations**

- Students may find the chemical names in the chart on page 277 somewhat confusing. Have your students colour code each term in the Example column of the chart and match this colour to the ingredient listed in **BLM 15–4 What Is in Toothpaste?** Once they have colour coded the ingredients, it should be easier to complete the last column on the chart.
- When dealing with the Science and Literacy Link on page 281, have students use a coloured pen to highlight or underline the sentences that describe how the teeth whitening strips were tested. Using their input, write these steps on the chalkboard in a numbered list:
  1. We used two brown eggs.
  1. We put our tooth whitener strip on one egg.
  3. We put the leading brand X strip on the other egg.
  4. After five days we removed both strips.
 Use this list to help students determine if this was or was not a fair test. You could also have them underline or highlight the “claim” made by this company. Link this claim to a discussion of being an informed consumer.

## Test It! Activity (page 278)

### Test Your Toothpaste

#### Purpose

- Students compare homemade toothpaste with a commercial brand.

#### Science Background

Abrasives remove stains and plaque, and also polish teeth. Common abrasives include sodium bicarbonate (baking soda), calcium phosphates, alumina, calcium carbonate, and silica. Toothpaste should be abrasive enough to remove plaque and stains, but not abrasive enough to damage tooth enamel.

The pH of some commercial toothpastes is approximately 10. A pH of 10 is basic (alkaline). This alkaline pH helps to neutralize the cavity-forming acids released by plaque-forming bacteria.

#### Advance Preparation

WHEN TO BEGIN	WHAT TO DO
3 to 4 days before	<ul style="list-style-type: none"> <li>• Make sure that you have all of the ingredients for the homemade toothpaste.</li> <li>• Purchase tube of commercial toothpaste.</li> <li>• Purchase toothbrushes.</li> <li>• Purchase and hard boil the eggs.</li> <li>• If you are not using brown eggs, stain the hard-boiled eggs in tea or a commercially available egg colouring kit.</li> </ul>

APPARATUS	MATERIALS
For each group: <ul style="list-style-type: none"> <li>• 250 mL beaker</li> <li>• medicine dropper</li> <li>• toothbrush</li> <li>• marker</li> </ul>	For each group: <ul style="list-style-type: none"> <li>• baking soda</li> <li>• salt</li> <li>• glycerin</li> <li>• stir stick or spoon</li> <li>• water</li> <li>• pH paper</li> <li>• hard-boiled egg</li> <li>• commercial toothpaste</li> <li>• stain for egg (if not using brown eggs)</li> </ul>

#### Suggested Timing

- 25 min to plan
- 25 min to conduct

#### Safety Precautions

- Students should wear aprons to protect their clothes from stains.
- Remind students not to taste the toothpaste or use it to clean their teeth in the science laboratory.
- Remind students not to eat in the science classroom.
- Students should wash their hands thoroughly at the end of the investigation.

#### Activity Planning Notes

Use this activity to review the idea of a fair test. Group students into teams of three or four to reduce the amount of materials that are required for this activity.

You could do this activity as a teacher demonstration. If you decide to do this as a demonstration, consider using the POE method.

- **Predict:** Have students predict what will happen when the egg is brushed with commercial toothpaste and with the homemade toothpaste.
- **Observe:** Have students record their observations in a chart that they make on page 280.
- **Evaluate:** Have students complete the What Did You Find Out? questions on page 280.

Using brown eggs can save the time required to stain the hard-boiled egg. If you wish to eliminate Step 3 in the What to Do section of this activity (students choosing their own staining method), you can soak the eggs in tea or commercially available egg colouring dyes ahead of time.

Review the terms “manipulated variable,” “responding variable,” and “controlled variables” prior to starting this activity. The type of toothpaste is the manipulated variable for this investigation. The removal of the stain is the responding variable. Controlled variables should be the type and length of stain applied to the egg, the amount of toothpaste used, the number of brush strokes used, and how many trials students conduct.

Have students use a marker to draw a square or a circle on the egg where they will apply the toothpaste.

**Accommodations**

- Students are required to do a lot of planning prior to starting the actual investigation. Consider doing the planning as a large group. Write the information on the chalkboard for students to copy into their student resource.

**Test It! Answers (pages 278–280)**

1. Questions will vary but might include one of the following:
  - Does homemade toothpaste clean better than a commercial toothpaste?
  - Is water as effective as toothpaste in cleaning a stained egg?
2. Students will likely predict that one of the toothpastes will clean better than the other toothpaste and the water.
3. Students may soak their eggs for several hours or overnight in a food colouring solution, tea, coffee, fruit drink, or other liquid.
4. The type of toothpaste is the manipulated variable for this investigation. The removal of the stain is the responding variable. Controlled variables should be the type and length of stain applied to the egg, the amount of toothpaste used, the number of brush strokes used, and how many trials they will conduct.
7. Answers will vary. The water and commercial toothpaste will likely be close to neutral (approximately 7) and the homemade toothpaste will be slightly basic (approximately 9).
8. The following is an example of an observation chart that students might choose to make.

Trial	Changes to Stained Egg with Commercial Toothpaste	Changes to Stained Egg with Homemade Toothpaste
1		
2		
3		

It is very difficult to predict what your students will observe. Actual results will depend on the material used to stain the eggs, the type of toothpaste used, how many times the egg was “brushed,” and the number of trials that the students do.

9. It was important to include brushing the egg with water but without toothpaste in order to make the experiment a fair test. Without this step you would not know whether it was the toothpaste or the brushing that removed the stain.
10. Answers will vary according to the commercial toothpaste used. There may be similar results for each toothpaste. The homemade toothpaste may be more abrasive and therefore may have removed stains better than the commercial toothpaste.

- 11. a)** baking soda: abrasive, scrubs away plaque  
 salt: abrasive, scrubs away plaque, adds flavour  
 glycerin: humectant, adds texture and moisture  
 water: holds ingredients together in a paste

- b)** fluoride, detergent, thickener, preservative, flavouring, colouring agent, sweetener

- 12.** Students will probably base their answer on the pH value of whichever toothpaste cleaned the stains better. Most likely, that would be the homemade version, which is slightly basic.

They might therefore conclude that the more basic a substance, the better its cleaning ability. In the case of toothpaste, a slightly basic substance is useful because it neutralizes acids that can cause cavities.

- 13.** There could be different results because of different commercial toothpastes used, different amounts of toothpaste, different numbers and pressures of brush strokes, different amounts and types of dye on eggs, and different methods of determining how well a toothpaste cleaned.

### Activity Wrap-up

- Link this activity to toothpaste commercials on television and in other media. You might ask the students about the types of claims that are made on these commercials and how they would know if the toothpaste actually does what the advertisers say it does.

### Try This! Activity (page 281)

#### Purpose

- Students design an investigation to test tooth whiteners on a brown egg.

#### Science Background

Most tooth whiteners use a peroxide gel to bleach teeth. Peroxide lightens teeth by penetrating past the enamel and into the dentin. Once inside, it bleaches brown and yellow stains found under the surface of the tooth. Tooth whiteners only work on natural teeth. They do not work on dental restorations such as crowns or caps. Before bleaching, it is important to consider how much of your existing dental work will have to be replaced to achieve the desired results.

### Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 or 3 days before	<ul style="list-style-type: none"> <li>• Purchase and hard boil the brown eggs.</li> <li>• Purchase tooth whitening strips and/or paste.</li> </ul>
1 day before	<ul style="list-style-type: none"> <li>• Photocopy <b>BLM 15-5 Are All Tooth Whiteners the Same?</b> and any assessment masters you decide to use.</li> </ul>

APPARATUS	MATERIALS
For each group: • permanent marker	For each group: • brown hard-boiled egg • tooth whitener strips or paste

### Suggested Timing

25 min to plan

10 min to apply the tooth whiteners

7 min per day for 3 days to change the whitening strips and record observations

### Safety Precautions

- Tooth whiteners contain chemicals that can damage clothing, leather, or fabrics.
- Remind students to wash their hands and clean up the work area at the end of the activity.

### Activity Planning Notes

Photocopy and distribute **BLM 15–5 Are All Tooth Whiteners the Same?** This blackline master provides the information and steps students need to follow in order to complete this activity.

Consider doing this activity as a demonstration for your students. This will save on the cost of whitening strips.

### Accommodations

- Demonstrate the procedure for this activity to give students an idea of what you want them to do. Provide examples of the eggs with the whitening strips on them to give your students a visual reference for this activity.

### Activity Wrap-up

- Students could work in groups to write a script for a television commercial promoting a tooth whitening product and how to use the product safely.
- Students could complete **Assessment Master 1 Co-operative Group Work Checklist** and/or **Assessment Master 13 Fair Test Checklist**.

### Ongoing Assessment

- Have students list the types of ingredients that are found in toothpaste and the function of each. Students should not be expected to know the actual chemical names.
- Have students list the active ingredient (peroxide) found in tooth whiteners and explain how the peroxide whitens tooth enamel.
- Collect and mark student answers to the questions in **BLM 15–5 Are All Tooth Whiteners the Same?**
- You might wish to use **Assessment Master 2 Co-operative Group Work Rubric** and/or **Assessment Master 14 Fair Test Rubric** to assess students during the Try This! activity.

### Technology Links

- For more information on toothpastes, go to [www.mcgrawhill.ca/books/Se9](http://www.mcgrawhill.ca/books/Se9) and follow the links to Toothpaste.
- For more information on tooth whitening, go to [www.mcgrawhill.ca/books/Se9](http://www.mcgrawhill.ca/books/Se9) and follow the links to Tooth Whiteners.



# Chapter 15 Review (page 282)

## SUGGESTED TIMING

30 min to complete and take up the review and assign Practice Test

## BLACKLINE MASTERS

Master 3 Certificate  
 Master 4 List of Skills  
 BLM 15–6 Chapter 15 Practice Test  
 BLM 15–7 Chapter 15 Test

### 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 15–6 Chapter 15 Practice Test** can be customized to produce extra reinforcement questions.

## 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 taking them up before continuing. This process will prevent students from completing many questions incorrectly.

Once the review is completed and taken up, assign **BLM 15–6 Chapter 15 Practice Test** for students to answer individually. They may wish to use their completed review to help them.

## Review Guide

Question	Section(s)	Refer to
1	15.2	How Do Toothpastes Work? (page 277)
2	15.1	How Do Sunscreens Work? (page 273)
3	15.1	How Do Sunscreens Work? (page 273)
4	15.1	The Science of Skin (page 271)
5	15.1	How Do Skin Creams Work? (page 272)
6	15.1	How Do Skin Creams Work? (page 272)
7	15.1	How Do Sunscreens Work? (page 273)
8	15.1	How Do Sunscreens Work? (page 273)
9	15.1	The Science of Skin (pages 271–273)
10	15.2	How Do Toothpastes Work? (page 277)
11	15.2	How Do Toothpastes Work? (page 277)
12	How to Think Like a Scientist, 15.2	What Are Variables? (page 4) Right about White? (page 281)

**Chapter 15 Review Answers (pages 282–283)**

1. **d)** plaque
2. **b)** sunscreen, **a)** ultraviolet rays
3. **c)** SPF, **b)** sunscreen
4. **a)** protects body cells  
**b)** keeps out dirt and bacteria  
**c)** helps control body temperature  
Also acceptable: acts as a boundary between you and the outside world
5. Drinking water helps keep your skin moist from the inside out.
6. Moisturizing cream puts moisture back into the skin and adds a film of oil on the skin's surface so the moisture does not evaporate as quickly.
7. The physical sunscreen diagram should show the sunscreen reflecting the ultraviolet rays. The chemical sunscreen diagram should show the sunscreen absorbing the ultraviolet rays.

8. You should wear sunscreen to protect your skin from ultraviolet rays. Some students might answer that sunscreen prevents your skin from being burned as quickly.
9. Students' answers will vary but might include understanding the importance of protecting the skin from too much exposure to the Sun and the importance of a diet with plenty of fruits, vegetables, and water.
10. **a)** scrub away plaque  
**b)** slow down the growth of plaque bacteria  
**c)** strengthen teeth
11. A toothpaste that is too abrasive could damage the outer layer of the teeth (tooth enamel).
12. **a)** and **b)** No. Jack's and Jill's skin might burn at different rates.  
**c)** Suggestions will vary, but might include each person putting one type of sunscreen on each half of their face.

**Summative Assessment**

- Have students complete **BLM 15-7 Chapter 15 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**.