

# Activity Preparation for How to Think Like a Scientist

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
<i>Test It! Paper Towel Test, Part 1</i> (page 3) (TR page 3)	<ul style="list-style-type: none"> <li>• 2 to 3 days before               <ul style="list-style-type: none"> <li>– Purchase three brands of paper towel, preferably brands that make different advertising claims on their packaging.</li> </ul> </li> <li>• 1 day before               <ul style="list-style-type: none"> <li>– Photocopy <b>BLM Intro–2 Show You Know! Measuring the Volume of Water Using a Graduated Cylinder.</b></li> </ul> </li> </ul>	• 25 min	• Make a bulletin board display that provides a visual reference for the terms manipulated variable, responding variable, and controlled variables.
<i>Test It! Paper Towel Test, Part 2</i> (page 5) (TR page 8)	<ul style="list-style-type: none"> <li>• 1 day before               <ul style="list-style-type: none"> <li>– Assign student groups and have groups plan their investigation by completing step 1 to step 7.</li> <li>– Photocopy any assessment masters you plan to use.</li> </ul> </li> </ul>	• 30 min to plan; 30 min to conduct and evaluate	• 1 class to introduce, brainstorm, and plan the investigation; 1 class to conduct and wrap-up the investigation
<i>Find Out: Evaluating Energy Drinks</i> (page 14) (TR page 16)	<ul style="list-style-type: none"> <li>• 2 to 3 days before               <ul style="list-style-type: none"> <li>– Book the computer lab.</li> <li>– Check access to energy drink web sites.</li> </ul> </li> <li>• 1 day before               <ul style="list-style-type: none"> <li>– Photocopy <b>BLM Intro–4 I Found It on the Internet, Assessment Master 1 Co-operative Group Work Checklist, and Assessment Master 2 Co-operative Group Work Rubric.</b></li> </ul> </li> </ul>	• 60 min	

# Materials Needed for How to Think Like a Scientist

Activity/Investigation	Apparatus	Materials	Blackline Masters
<i>Test It! Paper Towel Test, Part 1</i> (page 2) (TR page 3)	Per group: <ul style="list-style-type: none"> <li>• 3 – 250 mL beakers</li> <li>• 3 – 100 mL graduated cylinders</li> <li>• 3 funnels</li> <li>• timer</li> </ul>	Per group: <ul style="list-style-type: none"> <li>• 3 sheets of paper towel (each a different brand)</li> <li>• 300 mL water</li> </ul>	<b>Recommended</b> BLM Intro–2 Show You Know! Measuring the Volume of Water Using a Graduated Cylinder <b>Optional</b> Master 4 Safety Precaution Symbols
<i>Test It! Paper Towel Test, Part 2</i> (page 5) (TR page 8)	• depends on students	• depends on students	<b>Recommended</b> Assessment Master 11 Fair Test Checklist Assessment Master 12 Fair Test Rubric Assessment Master 17 Narrative Lab Report Checklist
<i>Find Out: Evaluating Energy Drinks</i> (page 14) (TR page 16)	• computer with Internet access	• energy drink labels	<b>Recommended</b> BLM Intro–4 I Found It on the Internet Assessment Master 1 Co-operative Group Work Checklist Assessment Master 2 Co-operative Group Work Rubric

# How to Think Like a Scientist (page 2)

## SUGGESTED TIMING

15 min for opening discussion  
25 min for Test It! Paper Towel Test, Part 1

## MATERIALS

- sports or fashion magazines, or newspapers

## BLACKLINE MASTERS

Master 4 Safety Precaution Symbols  
BLM Intro–1 Advertising Techniques  
BLM Intro–2 Show You Know! Measuring the Volume of Water Using a Graduated Cylinder  
OHT 6 and OHT 7 Test It! Paper Towel Test, Part 1

## Overall Expectations

**SIMV.01** – explain how science-related information is presented in print and electronic media for different purposes and audiences

**SIMV.02** – investigate science-related information presented in print and electronic media using appropriate research and reporting skills

**SIMV.03** – evaluate claims and presentations of science-related information in media

## Science Background

The introduction to the How to Think Like a Scientist section does not include a lot of science. This section of *Science Essentials 10* is designed to help students become more aware of advertising techniques. They use science skills to test advertising claims.

## Activity Planning Notes

You can take several approaches to introduce this section to your students. As a class, you might list different ways that companies advertise products. The obvious answers are television and radio commercials. Students may mention ads in newspapers and magazines, pop-up ads on web sites, and ads on billboards, taxis, tractor-trailers, company-owned cars and trucks, buses and bus shelters, and pop and candy machines. Some students may mention seeing ads in movie theatres, embedded in movies, and at sporting events. As well, many sports stars endorse specific products.

One study suggests that North American young people are bombarded by as many as 1500 ads every day. Although the original source of this data cannot be confirmed, one can assume that this statistic is not out of line. Consider giving students copies of sports or fashion magazines or newspapers, and have them count the number of ads in one print source, or suggest that they count the number of commercials they see while watching one hour of television.

Photocopy and distribute **BLM Intro–1 Advertising Techniques**. Provide students with print resources (e.g., magazines or newspapers) or access to video-taped television commercials or web sites that discuss media awareness. Have students use the blackline master to record their analysis of five or six ads.

## Test It! Activity (page 2)

### Paper Towel Test, Part 1

#### Purpose

- Students compare three brands of paper towel to determine which brand is the most absorbent.

#### Science Background

An absorbent material is one that has the capacity or tendency to absorb or soak up a liquid.

Two significant processes affect paper towel absorbency. The first is creping (as in crepe paper), which gives the towel flexibility and stretch and creates more open areas for water to enter. The second involves the number of plies (layers) of paper. For example, two layers of paper may be combined with a thin layer of adhesive and embossed to form many tiny air pockets that rapidly attract moisture. Shapes such as diamonds or circles are pressed into the paper to give a quilted pattern that improves a towel’s ability to hold moisture.

#### Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	<ul style="list-style-type: none"> <li>• Purchase three brands of paper towel, preferably brands that make different advertising claims on their packaging.</li> </ul>
1 day before	<ul style="list-style-type: none"> <li>• Photocopy <b>BLM Intro–2 Show You Know! Measuring the Volume of Water Using a Graduated Cylinder</b>.</li> </ul>

APPARATUS	MATERIALS
Per group: <ul style="list-style-type: none"> <li>• 3 – 250 mL beakers</li> <li>• 3 – 100 mL graduated cylinders</li> <li>• 3 funnels</li> <li>• timer</li> </ul>	Per group: <ul style="list-style-type: none"> <li>• 3 sheets of paper towel (each a different brand)</li> <li>• 300 mL water</li> </ul>

#### Suggested Timing

25 min

#### Safety Precautions

- Have students clean up the work area and wash their hands with soap and water after they finish the investigation. Tell students that cleaning up and washing hands is a good habit to get into whenever working in a lab.

#### Activity Planning Notes

Have students use **BLM Intro–2 Show You Know! Measuring the Volume of Water Using a Graduated Cylinder** to demonstrate their ability to measure the volume of a liquid in a graduated cylinder. This blackline master is patterned on the “Show You Know!” certificates used in the *Science Essentials 9* program.

Consider reviewing the safety precautions symbols that students will see throughout the student resource by using **Master 4 Safety Precaution Symbols**. These symbols are also at the back of the student resource.

Consider using **OHT 6** and **OHT 7 Test It! Paper Towel Test, Part 1** to walk students through the procedure.

Organize the students into teams of three. Remind students that they are trying to control all of the variables except one. The manipulated variable is the brand of paper towel and the responding variable is the absorbency of each brand of paper towel.

Consider asking students to make a prediction before starting. If so, have the prediction based on the product advertising or package claims.

### Accommodations

- You might approach this activity as a teacher-lead demonstration. If so, consider using the P.O.E. method to get students involved in the demonstration. This method is summarized below:

#### Predict

Present students with a particular set-up of equipment and describe the procedure. Next, have students make predictions about what will happen and explain why they think so. Then compile a list of explanations and have the class take a secret vote to determine the popularity of a theory. The “heads down” way of voting allows for a more independent voting process.

#### Observe

Carry out the demonstration and observe the results. One of the predicted outcomes may be correct. More often, either more than one predicted outcome or none of the predicted outcomes may be correct.

#### Explain

As a class, have students deconstruct the demonstration and explain why things happened the way they did.

- Pair students with physical disabilities with those without disabilities.

#### Test It! Answers (page 3)

7. Student answers will depend on the brand of paper towels tested. It is likely that students will not notice a significant difference in the volume of water collected. Use this as a teaching moment to explain that some

advertisers make vague claims using words, such as “best.” All that they are really saying is that their brand is as good as all of the other brands tested. Sample answers are provided in the table.

Brand Name of Paper Towel	Volume of Water Collected in the Graduated Cylinder (mL)	Volume of Water Absorbed by the Paper Towel (100 mL – amount collected)
Brand X	43	57
Brand Y	56	44
Brand Z	33	67

9. Answers will depend on the variety of paper towels tested. In the example, the graduated cylinder with Brand Y contained the most water.
10. Answers will depend on the variety of paper towels tested. In the example, the graduated cylinder with Brand Z contained the least amount of water.
11. Student answers will depend on the variety of paper towels tested. In the example, Brand Z held the most water.
12. Student answers will depend on the variety of paper towels tested. In the example, Brand Z was the most absorbent. Explanations will vary. Sample answer:
  - The brand that released the least amount of water back into the graduated cylinder is the most absorbent.

### Activity Wrap-up

- Have students complete the questions on page 3.
- Have students identify the manipulated and responding variables and list all of the variables that they controlled.
- Discuss why it is difficult to accurately describe terms used in advertising, such as “more absorbent.”

## Diagnostic Assessment

This is the first time the students have performed an investigation. During the first Test It!, observe how well they understand the method. Some things to consider include:

- Do students understand the purpose of the Question?
- How well do students understand and follow safety precautions?

This may be the first time that students have worked together as a team. Observe how well they worked together.

- Was the group organized?
- Did all individuals participate in the activity?
- Did all members of the group take their roles seriously?

## Alternative Activity

- **Water Speed**—Have students test the speed of the water moving through a paper towel. The more rapidly the water moves, the more absorbent the towel.
  - Method 1
    1. Place a paper towel in an embroidery hoop.
    2. Draw a circle 5 cm in diameter in the centre of the towel.
    3. Using a medicine dropper, add water one drop at a time in the centre of the circle.
    4. Count the number of drops added until the water spreads out to fill the circle. The towels requiring fewer drops are the more absorbent ones.
  - Method 2
    1. Place a paper towel in an embroidery hoop.
    2. Draw a circle 5 cm in diameter in the centre of the towel.
    3. Using a medicine dropper, add 10 drops of water in the centre of the circle.
    4. Measure the time it takes for water to spread out and fill the circle. The towels with shorter times are the more absorbent ones.
  - Method 3
    1. Cut the paper towels into strips 2.5 cm wide and 15 cm long.
    2. Draw marks 2.5 cm from each end with a pencil.
    3. Fill a cup with water.
    4. Use tweezers to hold each strip vertically, with the bottom end in the water up to the marked line.
    5. Measure the time it takes for water to travel from the bottom mark to the top mark. This measures how quickly the towel absorbs water. The faster the water moves through the towel, the more absorbent the towel.

# What Makes a Fair Test? (page 4)

## SUGGESTED TIMING

15 min to review variables  
60 min for Test It! Paper Towel  
Test, Part 2

## MATERIALS

- 3 sheets of paper towel (each a different brand)
- 3 – 100 mL graduated cylinders
- 3 funnels
- water

## BLACKLINE MASTERS

OHT 1 Creating a Narrative Lab Report  
OHT 8 Types of Variables  
OHT 9 to OHT 11 Test It! Paper Towel Test, Part 2  
Assessment Master 11 Fair Test Checklist  
Assessment Master 12 Fair Test Rubric  
Assessment Master 17 Narrative Lab Report Checklist

## Specific Expectations

- SIM2.01** – formulate testable questions on science-related claims and conduct investigations based on the concept of a fair test
- SIM2.03** – interpret research data, including analysis for accuracy and bias as appropriate, using a range of strategies for reading for information
- SIM2.04** – organize and communicate information collected from lab investigations and information research using graphic organizers

## Science Background

The focus of this section is to review the concept of a fair test introduced in *Science Essentials 9*. Explain that investigations must have the ability to be duplicated because the answers that scientists come up with (whether these support or refute the original hypothesis) cannot become part of the knowledge base unless other scientists can perform the exact same experiment(s) and achieve the same results.

Some of your students may question why the results of an unverified experiment may be considered useless. The simple reason is variables. Variables change, differ, and are not the same. A well-designed experiment needs to have one manipulated variable and a responding variable. The manipulated variable is what the scientist changes in the experiment. The responding variable changes based on how the manipulated variable is changed. Therefore, the responding variable provides the data for the experiment. All other variables must be controlled (kept the same) in order for the experiment to be considered a fair test.

## Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember the key terms:

- Write definitions for these terms in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.

- Write a paragraph that contains the key terms in this section.

Help students remember the key words by posting them on a science word wall.

#### Reading Icon Answer (page 4)

1. Students should highlight manipulated, responding, and controlled.

### Activity Planning Notes

Consider using the materials (graduated cylinder, funnel, paper towel, water) in the previous investigation as visual props to help explain the different variables.

Use **OHT 8 Types of Variables** to help students complete question 2 on page 4.

If students have trouble with the idea of a fair test, set up a quick demonstration based on the first investigation. This time, use three brands of paper towel but change a number of variables. For example, put three sheets of one brand of paper towel in one funnel, two sheets of another brand in a second funnel, and one sheet of the third brand in the third funnel. Use 200 mL water in one cylinder, 100 mL water in a second one, and 50 mL water in a third. Ask your students to identify the manipulated variable in the demonstration. They should come up with the idea that because you manipulated several things, it is impossible to determine which has the most influence on the responding variable.

#### Check Your Understanding Answers (page 4)

2. Sample answers:

- Manipulated: the types of paper towel used
- Responding: the absorbency of the paper towel (how much water it held)
- Controlled: the size of the paper towel; the amount of water used; the size of graduated cylinders and beakers; the temperature of the water

3. Answers may vary. Sample answer:

- The test was fair because all the variables were controlled except for the manipulated and responding variables.

## Test It! Activity (page 5)

### Paper Towel Test, Part 2

#### Purpose

- Students design an investigation to test the strength of different brands of paper towel.

#### Science Background

A good paper towel should be strong and durable so it holds together when you use it. Having the right amount of wood fibres in the paper gives the towel the right structure and makes it substantial enough to perform well. Some of the newer innovations in paper composition make it possible to wash or rinse the towel and use it several times, whereas earlier versions of paper towels had limited endurance.

#### Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	<ul style="list-style-type: none"><li>• Assign student groups and have groups plan their investigation by completing step 1 to step 7.</li><li>• Photocopy any assessment masters you plan to use.</li></ul>

APPARATUS	MATERIALS
<ul style="list-style-type: none"><li>• depends on students</li></ul>	<ul style="list-style-type: none"><li>• depends on students</li></ul>

#### Suggested Timing

30 min to plan the investigation; 30 min to conduct and evaluate the investigation and experimental design

#### Safety Precautions

- Safety precautions will depend on the experimental design selected by students.
- Ensure that students have included cleaning up and washing hands in their safety precautions.

## Activity Planning Notes

Consider using OHT 9 to OHT 11 **Test It! Paper Towels, Part 2** to introduce the activity.

Assign students into groups of three or four and have each group plan their investigation by completing step 1 to step 7 on pages 5 to 7. Pay attention to step 4, which asks students to list the steps that they will follow to do a fair test. Discuss what would make a fair test. Read student steps and correct any errors in their experimental design.

#### Accommodations

- Some students may have difficulty putting their steps in logical order. Have them write out the steps on one side of a piece of paper and then cut out the steps. They can rearrange the steps until they are in logical order, and then glue the steps in place on one of the blank pages or inside the front cover of their student resource.

#### Test It! Answers (pages 5–7)

Answers in this activity will depend on the experimental design. The following answers are based on the procedure shown in the first Alternative Activity on page 10 in this teacher resource.

1. I predict that Brand X is the strongest paper towel because it is the thickest.
2.
  - Place the embroidery hoop in a place where the washers won't land on my feet.
  - Clean up the work area and wash my hands with soap and water after finishing the activity.
3. Three brands of paper towel (Brand X, Brand Y, Brand Z), an embroidery hoop, 20 large metal washers, 10 mL graduated cylinder, water, a sink or area to support the embroidery hoop

#### Planning the Test

I will test strength by finding the mass that a wet towel can hold before tearing. I will use a chart to organize information about features of paper towels.

Sample chart:

Features	Same ✓	Different ✗
Size of sheets	✓	
Colour of sheets		✗
Texture (smooth or bumpy)	✓	
Thickness	✓	

4. • Put one sheet of paper towel (Brand X) in an embroidery hoop and suspend the hoop over a sink.
- Using a graduated cylinder, gently add 5 mL of water to the centre of the hoop. Wait 30 s.
  - Place a large washer on the centre of the towel.
  - Wait 3 s and place another washer on the centre of the towel.
  - Continue adding washers until the towel breaks.

- Record the number of washers on the paper towel before the towel ripped.
- Repeat the steps using Brand Y and Brand Z paper towels.

5. brands of paper towel
6. number of washers added before the paper towels rip
7. amount of water, size of washers, time interval between adding washers, size of the embroidery hoop
8. Brand X held 10 washers. Brand Y held 12 washers. Brand Z held 18 washers.
9. No, my prediction was incorrect. Brand X did not hold the most washers.
10. Yes, my investigation was a fair test because I changed only one variable and controlled all of the other variables.

### Activity Wrap-up

- Using **Assessment Master 11 Fair Test Checklist**, have students assess whether or not they developed a fair test. Use the checklist to review the features of a fair test. Discuss what changes might make the test unfair.

- Have students complete the narrative lab report on page 8. Use **OHT 1 Creating a Narrative Lab Report** to introduce students to writing a lab report using this format. You might provide students with a copy of **Assessment Master 17 Narrative Lab Report Checklist** to help them assess the completeness of their report.

### Narrative Lab Report Answers (page 8)

Sample answers are provided.

Activity title: Testing the Strength of Paper Towels

1. I was trying to determine which brand of paper towel was the strongest. I decided to test the strength of paper towels by determining the mass that a wet towel could hold before tearing. I predicted that Brand X would be the strongest paper towel.
2. I placed a paper towel in an embroidery hoop to maintain a constant tension. I used a graduated cylinder to add 5 mL of water to the centre and
- waited 30 s. Then I placed a large washer in the centre of the hoop, waited 3 s, and placed another washer on the centre of the towel. I added washers every 3 s until the towel ripped. I recorded the number of washers on the paper towel before the towel ripped. Holding more washers corresponds to stronger towels.
3. I found that Brand X held 10 washers before it ripped. Brand Y held 12 washers and Brand Z held 18 washers.
4. This means that Brand Z is the strongest paper towel that I tested. It means that I should use this brand when I need a really strong paper towel.

### Ongoing Assessment

- You may wish to use **Assessment Master 12 Fair Test Rubric** to assess student work in the investigation.
- Collect and assess the narrative lab reports.

### Technology Links

- For information about testing paper towels go to [www.mcgrawhill.ca/books/Se10](http://www.mcgrawhill.ca/books/Se10) and follow the links to About Paper Towels.
- For information about the history of toilet paper and other paper products, go to [www.mcgrawhill.ca/books/Se10](http://www.mcgrawhill.ca/books/Se10) and follow the links to Historical Facts.

## Alternative Activity

- Consider trying some of the following variations for testing strength of a paper towel by finding the weight that a wet towel can hold before tearing.
  - Place a paper towel in an embroidery hoop to maintain a constant tension. Add 5 mL of water to the centre and wait 30 s. Then place a large washer in the centre of the hoop, wait 3 s, and place another washer on the towel, continuing until the towel tears. Record the number of washers on the paper towel before the towel tears. The stronger towels will hold more washers.
  - Place a paper towel in an embroidery hoop. Place 5 washers in the centre of the paper towel. Use a medicine dropper to add drops of water in the centre of the towel. Count the number of drops until the towel breaks. The stronger towels will be able to sustain the weights with the larger amounts of water.
  - Attach a string to an embroidery hoop. Place a paper towel in the embroidery hoop. Then place 25 washers on the towel in the hoop. Wet a rough surface, such as concrete, and drag the hoop across the wet surface. Measure the distance travelled before the paper shreds and some washers fall out. The stronger paper towels will be able to travel a farther distance.

# Scientific Method (page 9)

## SUGGESTED TIMING

15 min

## BLACKLINE MASTERS

OHT 12 Scientific Method

## Specific Expectations

**SIM1.02** – discuss, using examples, how the method of presenting scientific information connects to the purpose

## Activity Planning Notes

Use **OHT 12 Scientific Method** to guide students through the review of the scientific method on page 9. Have them place a check mark in the column at the right for each scientific skill they used during Paper Towel Test, Part 2.

### Ongoing Assessment

- Check that students have checked off the following scientific skills on page 9.
  - Predict
  - Plan the investigation
  - Conduct the investigation
  - Measure and record
  - Analyze
  - Conclude
  - Evaluate
  - Communicate
- Have students discuss and consider what they might do for Gather information.

# Advertising Claims (page 10)

## SUGGESTED TIMING

20 min for introduction; 30–40 min if extending the activity

## MATERIALS

- sample ads that use techniques, such as celebrity endorsement, scientific/statistical claim, or create a sense of urgency (optional)
- magazines and newspapers (optional)

## BLACKLINE MASTERS

BLM Intro–3 Test It! Balanced Golf Balls, Part 1 and Part 2

## Specific Expectations

**SIM3.01** – formulate testable questions about science-related claims and representations in the media

**SIM3.02** – develop procedures to assess these claims and representations, using information research and/or laboratory investigations

## Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember the key term:

- Use a highlighter pen to highlight the advertising claims in Crash Carmichael’s statement.
- Relate these claims to advertisements of products in the real world.

Help students remember the key word by posting it on a science word wall.

## Reading Icon Answer (page 10)

1. Students should highlight the following words:  
part of an ad that claims how the advertised product is better than other products.

## Accommodations

- Some students may not understand how advertising attempts to create a sense of urgency. If time permits, make a videotape of a television infomercial (e.g., selling kitchen gadgets). This would help illustrate this technique.

## Activity Planning Notes

Consider showing some examples of ads that use techniques, such as celebrity endorsements, and scientific/statistical claims, or create a sense of urgency to sell products. You might have students search for and share ads that use similar advertising techniques. You might provide magazines and newspapers for this purpose.

As a class, read and discuss the ad and the claims made. Have students complete and then discuss question 2 on page 10.

### Making Connections Answer (page 10)

#### 2. Sample answer:

- **Celebrity endorsement or Expert testimonial:**  
A pro-football player is the spokesperson and states how many awards he has won. He says we can play as well as he does if we use the football that he uses.

- **Scientific/statistical claim:** The coach and a team of research scientists have shown that 42% of footballs miss their target because they are unbalanced.
- **Creating a sense of urgency:** It is a limited-time offer. Call within the next 5 days and buyers will get a book absolutely free.

## Alternative Activities

- Ask students to find and be prepared to share two ads that use celebrity endorsements, two ads that use scientific claims, and two ads that attempt to create a sense of urgency.
- Have students use **BLM Intro–3 Test It! Balanced Golf Balls, Part 1 and Part 2** to test the claim that golf balls are unbalanced.

### Ongoing Assessment

- Use students' answers to question 2 to assess understanding of advertising techniques.

### Technology Links

- For student-friendly information about advertising techniques, go to [www.mcgrawhill.ca/books/Se10](http://www.mcgrawhill.ca/books/Se10) and follow the links to Don't Buy It.

## SUGGESTED TIMING

15 min for introduction  
60 min for Find Out

## MATERIALS

• 3 different brands of energy drinks

## BLACKLINE MASTERS

BLM Intro–4 I Found It on the Internet  
BLM Intro–5 BLM Answers  
OHT 5 PMI Chart  
OHT 13 Compare Energy Drinks  
Assessment Master 1 Co-operative Group Work Checklist  
Assessment Master 2 Co-operative Group Work Rubric

## Specific Expectations

**SIM2.02** – research science-related information from a variety of electronic and other sources

**SIM2.03** – interpret research data, including analysis for accuracy and bias as appropriate, using a range of strategies for reading for information

**SIM2.04** – organize and communicate information collected from lab investigations and information research using graphic organizers

**SIM3.01** – formulate testable questions about science-related claims and representations in the media

**SIM3.02** – develop procedures to assess these claims and representations, using information research and/or laboratory investigations

## Science Background

Energy drinks can contain some or all of the following medicinal ingredients.

**Taurine:** This amino acid is important in several metabolic processes of the body. Taurine functions in electrically active tissues, such as the brain and heart to help stabilize cell membranes. It also has functions in the gallbladder, eyes, and blood vessels and may have some antioxidant and detoxifying properties.

**Glucuronolactone:** This substance is manufactured by the human body. It has some detoxifying properties. There is little research on the effects and so the risk to humans cannot be adequately assessed.

**Caffeine:** This alkaloid is found naturally in foods, such as coffee beans, tea, kola nuts, Yerba maté, guarana, and (in small amounts) cacao beans.

**Niacin (niacinamide):** This water-soluble vitamin has an essential role in energy metabolism in cells. Severe lack of niacin causes a deficiency disease called pellagra. A mild deficiency slows down the metabolism, which in turn decreases cold tolerance and is a potential contributing factor to obesity.

**Pantothenic acid (calcium d-pantothenate):** This antioxidant, water-soluble vitamin breaks down carbohydrates, proteins, and fats. It is found in whole-grain cereals, legumes, eggs, meat, and other foods.

**Vitamin B6 (pyridoxine HCl):** This water-soluble vitamin exists in three chemical forms: pyridoxine, pyridoxal, and pyridoxamine. Vitamin B6 performs a variety of functions in the body, such as protein and red blood cell metabolism. Vitamin B6 helps the nervous and immune systems to function efficiently and is needed to convert tryptophan (an amino acid) to niacin.

### Technology Links

- For information on Red Bull that was presented on CBC Marketplace, go to [www.mcgrawhill.ca/books/Se10](http://www.mcgrawhill.ca/books/Se10) and follow the links to Your Health: Energy Drinks.

**Riboflavin:** Also known as Vitamin B2, riboflavin is an easily absorbed, water-soluble vitamin. Like the other B vitamins, it helps metabolize fats, carbohydrates, and proteins. It can be found in milk, cheese, leafy green vegetables, liver, yeast, almonds, and mature soybeans.

**Vitamin B12 (cyanocobalamin):** This vitamin helps maintain healthy nerve cells and red blood cells, and is needed to produce DNA. Deficiency of vitamin B12 is the cause of several forms of anaemia.

## Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember the key term:

- Highlight the description of a media literate person.
- As a class, read the article about energy drinks on page 12. Have students underline the ingredients of energy drinks and circle the side effects.

Help students remember the key word by posting it on a science word wall.

### Reading Icon Answer (page 11)

1. Students should underline the following description: can tell which messages give information, and which messages are trying to sell something.

### Reading Icon Answers (page 12)

1. Students should underline the following effects of ingredients: caffeine reduces tiredness and increases heart rate; taurine helps break down fats; and glucuronolactone is claimed to reduce tiredness and make people feel happier.
2. Students should circle the following side effects: bad headaches, nausea, vomiting, breathing problems, and heart problems.

## Activity Planning Notes

As a class, read and discuss the information about media literacy on page 11. Have students complete and then discuss questions 2 to 5.

Read the article on page 12 together as a class. Focus students' attention on the effects of the ingredients and the risks associated with consuming energy drinks.

Bring in three different brands of energy drinks. Have students compare the ingredients in each brand and make connections to the effects of the ingredients on the human body.

### Accommodations

- ESL and LD Learners could be paired with students who have stronger language skills.
- Help students create a study guide of concepts about media literacy and advertising techniques presented in this section. Encourage students to use point-form notes and graphic organizers to highlight key terms and concepts. Encourage advanced students to create a digital version of the guide using software, such as PowerPoint™.

### Check Your Understanding Answers (page 11)

2. final exams
3. She thinks he will go to the library and study for exams.
4. He plans to buy a case of Red Bull.

### Making Connections Answer (page 11)

5. Answers will vary. Look for an opinion and supporting ideas. Sample answer:
  - I am unsure that drinking Red Bull will help him study. A media literate person needs to know the following information about energy drinks: ingredients, effects of ingredients, side effects, and how to use energy drinks safely.

### Analyzing Energy Drinks Answers (page 13)

3. **d)** all of the above
4. **b)** electrolytes
5. **c)** increase physical endurance and mental alertness
6. **c)** Energy drinks contain large quantities of caffeine.
7. **d)** All of the above statements are true.
8. Sample answer: Sports drinks replace nutrients that are lost from the body during exercise. Sports drinks provide water, sugars for energy, and electrolytes. Energy drinks do not contain electrolytes, but do contain sugar and some vitamins and minerals. Energy drinks also contain large amounts of caffeine, taurine, and glucuronolactone.

## Find Out Activity (page 14)

### Evaluating Energy Drinks

#### Purpose

- Students research energy drinks to learn more about why people use these drinks and how safe they are.

#### Science Background

Energy drinks are different from sports drinks, which rehydrate the body. Sports drinks provide sugars, which the body burns to create energy, and electrolytes, which maintain salt and potassium balances in the body.

Energy drinks provide mental and physical stimulation for a short period of time. Problems arise when people consume too many energy drinks or mix them with alcohol. For example, energy drinks have become popular at all-night dance bars and clubs. People drink them to sustain their energy during periods of intense physical activity or after exercise to quench their thirst. Energy drinks may, however, actually lead to dehydration.

## Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	<ul style="list-style-type: none"><li>• Book the computer lab.</li><li>• Check access to energy drink web sites.</li></ul>
1 day before	<ul style="list-style-type: none"><li>• Photocopy <b>BLM Intro–4 I Found It on the Internet, Assessment Master 1 Co-operative Group Work Checklist, and Assessment Master 2 Co-operative Group Work Rubric.</b></li></ul>

APPARATUS	MATERIALS
<ul style="list-style-type: none"><li>• computer with Internet access</li></ul>	<ul style="list-style-type: none"><li>• energy drink labels</li></ul>

## Suggested Timing

60 min

## Activity Planning Notes

In advance, book the computer lab or library. Check that the computers can access the commercial web sites for each brand of energy drink. Some filtering systems may prevent access to these kinds of web sites.

Before evaluating energy drinks, prepare students by providing them with a copy of **BLM Intro-4 I Found it on the Internet**. The blackline master reinforces the importance of checking for accuracy when reading information on the Internet. Read the information together as a class before having students analyze a web site they choose.

After providing an opportunity for students to share their findings, lead in to the Find Out activity by reading the information together on pages 14 and 15.

Assign groups and have each group research a different type of energy drink. Help students use key words to find the web sites for their energy drink. Have them answer question 4. As you circulate, make sure that students are on task.

Alternatively, you might do the activity as a class. Use an Internet-enabled computer connected to a LCD projector and display the web site for one or two energy drinks. Use the questions on pages 14 and 15 to guide the class discussion.

## Accommodations

- Pair students who have difficulties using computers with those who are particularly knowledgeable.
- Have students who have difficulty writing discuss the answers orally.
- Provide students who need more space to record their answer to question 5 with a photocopy of **OHT 13 Compare Energy Drinks**. Make sure they write their name on it.
- Likewise, provide such students with a copy of **OHT 5 PMI Chart** to record their answer to question 7.

## Technology Links

- For commercial web sites about energy drinks, go

to [www.mcgrawhill.ca/books/Se10](http://www.mcgrawhill.ca/books/Se10) and follow the links to Energy Drinks.

Note: Please check commercial web sites for inappropriate images or links to inappropriate web sites.

## Find Out Activity Answers (pages 14–15)

4. Answers will vary depending on the energy drink.
5. Answers will vary depending on the energy drinks.
6. Answers may vary. Look for four health and safety issues. Sample answer:
  - a) mixing energy drinks with alcohol
  - b) engaging in intense exercise without drinking enough water
  - c) drinking larger amounts than recommended
  - d) bad headaches, nausea, and vomiting
7. Answers will vary. Look for at least two points for each category.
8. Answers may vary. Look for an opinion and supporting ideas. Sample answer:
  - No. I would not recommend using energy drinks to prepare for an exam because people can become dehydrated, get a headache, or experience nausea or vomiting. All these side effects could affect performance on an exam.

## Activity Wrap-up

- Have students share their findings in a class discussion before assigning question 5 in which they compare two energy drinks. Consider using **OHT 13 Compare Energy Drinks** to demonstrate how to complete the Venn diagram.
- Have students complete and then discuss questions 6 to 8. Before students begin, consider using **OHT 5 PMI Chart** to introduce and explain how to fill in the PMI chart.
- Consider having students assess how well they worked as a group by completing **Assessment Master 1 Co-operative Group Work Checklist**.

### Ongoing Assessment

- Use student work in this activity to assess their ability to evaluate energy drinks.
- You may wish to assess students using **Assessment Master 6 Scientific Communication Rubric**.

### Technology Links

- For information about energy drinks from Health Canada, go to [www.mcgrawhill.ca/books/Se10](http://www.mcgrawhill.ca/books/Se10) and follow the links to Safe Use of Energy Drinks.
- For information about energy drinks from a sports nutrition point of view, go to [www.mcgrawhill.ca/books/Se10](http://www.mcgrawhill.ca/books/Se10) and follow the links to Peak Performance Energy Drinks.

## Alternative Activities

- Have students compare the information about energy drinks from commercial web sites with the information from Health Canada.
- Have students develop a short multimedia presentation that describes the risks associated with consuming energy drinks.