Activity Preparation for Chapter 4

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
Find Out: Weigh the Issues (page 79) (TR page 100)	• 2 days before – Gather samples of hair dye or packaging that show the steps and components. – Photocopy **BLM 4–2 PMI Chart** (optional).	• 45 min	• Help students conceptualize weighing plusses and minuses by using a straight arm balance and a set of masses.
Try This! (page 81) (TR page 105)	• 1 week before – Book a computer lab with Internet access.	• 30 min	• Encourage students to consider the bias on the web page.
Find Out: Types of Plastic (page 82) (TR page 105)	• 1 week before – Ask students to collect plastics with recycling codes 1 through 7. – Collect samples of plastic. • 2 days before – Collect or print resources for students to use. • Day of – Display plastic samples.	• 45 min	• A week before, have students start bringing in plastics. Show a variety of examples and explain how to find the recycling code. • Check the Technology Links on page 106 of the teacher resource for resources you can provide to students.
Find Out: Are Plastics Positive or Negative? (page 88) (TR page 108)	• 2 days before – Photocopy **BLM 4–2 PMI Chart**.	• 30 min	

Materials Needed for Chapter 4

Activity/Investigation	Apparatus	Materials	Blackline Masters
Find Out: Weigh the Issues (page 79) (TR page 100)	• straight arm balance and a set of masses	• sample of a peroxide-free hair dye such as henna (optional)	**Optional** BLM 4–2 PMI Chart
Try This! (page 81) (TR page 105)	• computer with Internet access		
Find Out: Types of Plastic (page 82) (TR page 105)		• plastic samples	**Recommended** OHT A–19 Types of Plastic
Find Out: Are Plastics Positive or Negative? (page 88) (TR page 108)			**Recommended** BLM 4–2 PMI Chart

CHAPTER 4 Reacting to Issues

(page 74)

SUGGESTED TIMING	MATERIALS
20 min	• shampoo or detergent container listing phosphate as an ingredient • chart paper and markers

Overall Expectations

CIMV.01 – understand how chemicals in common household and workplace materials interact
CIMV.03 – analyse how material interactions affect our daily lives
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

Chemicals are pervasive in packaging, electronics, clothing, and the manufacturing process. Some known harmful effects of chemicals include:
Flame Retardants: Retardants (BFR) pose a health concern and are found in a wide variety of items from newspapers to children's clothing.
Plastics: Plastics release cancer-causing substances when heated during manufacture.
Fluorocarbons: Also known as greenhouse gases, fluorocarbons have been eliminated from many aerosols and foam plastics, but may be used during manufacture. They are also found in ski and snowboard waxes, as well as cooling technologies, such as refrigeration and air conditionering.
Cigarette Smoke: Chemicals in cigarette smoke include benzene, acetone, arsenic, formaldehyde, and toluene.
Offgassing: The new smell of soft plastics, such as vinyl, is the result of offgassing. This means that the phthalate is evaporating from the plastic and people breathe in this hormone disruptor. Phthalates are a common plasticizer. They give plastics their flexible property. In animals they can cause feminization and impair fertility and intelligence. Offgassing happens throughout a plastic's life span until all of it has migrated out of the material, and the plastic becomes brittle.

Key Terms Teaching Strategies

Have students complete the following activity to help them learn and remember the key term:
- Write a definition for the term in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.

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

Reading Icon Answer (page 74)

1. Students should underline the useful reaction: solvents remove stains.

Students should circle the dangerous reaction: dioxins that cause cancer.

Activity Planning Notes

Direct students to the picture on page 74 and ask a volunteer to read the phosphate caption aloud. Point out the phosphate in an ingredient list from a shampoo or detergent bottle. Some dishwasher detergents and fertilizers contain the same concentration of phosphorous.

As a class, read the rest of the page. Then, brainstorm a list of chemicals that students used in the past week. List them on chalkboard or chart paper to help students answer question 2.

As a class, discuss the answers to question 2. Decide if selected chemicals are harmful when made, used, or thrown out. Ask students to share what they know about the environmental and/or health effects of the products they use. Students may say "not sure" if they do not know, but encourage them to find out. You may wish to direct students to information from environmental protection groups or health agencies. See the Technology Links to the right for more information.

Tell students that not all chemicals are listed as ingredients on product labels. Chemicals make up everything. They're found in packaging, products such as electronics and clothing, and sometimes only in the production process. Add any links between products and chemicals that students mention to the brainstormed list. For example, you might prompt students to discuss second-hand smoke, offgassing, flame retardants, or fluorocarbons.

Explain that some chemicals are a concern because they accumulate in the body when people use the product, or enter the body through the environment once the product is thrown out. Some chemicals are passed on to babies through mother's milk, giving them a head start on bioaccumulation. (They will learn more about bioaccumulation in Unit C.) The harmful effects of these chemicals may not be known.

Technology Links

- For information on fluorocarbons including effects on health and the environment, and workplace and environment precautions, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Health Effects.
- For more information on fluorocarbons, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Fluorocarbons.
- For information on phosphates, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Soaps and Detergents.
- For information on plastics that details manufacturing concerns, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Hidden Hazards of Plastics.
- For information about the hazards of soft plastic toys, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Toys.
- For clickable pictures of electronic waste that emphasize the hazards of exposure, go to **www.mcgrawhill.ca/books/Se10** and follow the links to E-Waste.

Making Connections Answers (page 74)

2. a) and **b)** Sample answers:

- oil paint: harmful when made, used, and thrown out
- shampoo containing phosphates: harmful when thrown out (e.g., rinsed down drain)
- cellphone: harmful when thrown out

4.1 Daily Decision-Making (page 75)

SUGGESTED TIMING
20 min

MATERIALS
- spray and solid deodorant samples

Specific Expectations

CIM3.02 – analyse the costs and benefits of a specific material with reference to its interactions with other materials in the environment

CIM3.03 – communicate an opinion, supported by evidence, about the use of a particular material, with consideration for both its physical and chemical interactions

Accommodations

- Have students highlight each property as they read to help them participate in the brainstorm class.

Activity Planning Notes

Have two volunteers role-play the dialogue shown on page 75. Provide several deodorant samples as props.

As a class, brainstorm other properties of deodorants that will help a consumer decide. Encourage students to make positive comments and discourage negative ones. Students may need practice accepting other people's opinions.

Have students complete and then discuss question 3 on page 75. Consider asking students to share their strategies for making decisions and situations when decision-making is a useful skill.

Making Connections Answers (page 75)

3. a) and **b)** Sample answers:

- how much time to spend on homework: considered volume of homework, other things to do
- whether or not to go out on the weekend: considered pros and cons of activity, who was joining in, cost, other obligations
- whether or not to buy a certain item: considered cost and whether I could afford it

Ongoing Assessment

- Monitor student behaviour and ability to accept others' opinions.
- Use **Assessment Master 2 Co-operative Group Work Rubric** to assess how well students participated and worked together in the brainstorm.

Alternative Activities

- Show a video that features decision-making skills, such as *Street Test: Antiperspirant* described in the Technology Links in this section.
- Present a media piece that features the costs and benefits of making a decision. Consider shampoos or detergents containing phosphates, alternative fuels, or recycling. See the Technology Links in the Chapter Opener.

Technology Links

- For a popular media evaluation of choosing a deodorant, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Deodorant Decisions. This Canadian program includes decision-making skills in some episodes.

4.2 Back It Up (page 76)

SUGGESTED TIMING	BLACKLINE MASTERS
45 min	BLM 4–1 Back It Up

Specific Expectations

SIM1.01 – identify the ways in which scientific information is conveyed
CIM3.02 – analyse the costs and benefits of a specific material with reference to its interactions with other materials in the environment
CIM3.03 – communicate an opinion, supported by evidence, about the use of a particular material, with consideration for both its physical and chemical interactions

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 the terms in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.
- Present a news editorial or letter to the editor and have students identify the different kinds of support used to make an argument.

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

Reading Icon Answers (page 77)

1. a) Students should underline:

- PERC works better than water at removing oils and grease from clothes.
- Its chemical structure is like the chemical structure of oils and grease.
- It's a very responsible process.

b) Students should highlight:

- PERC is a colourless, non-flammable, liquid, organic solvent.
- Inside cleaning machines, PERC solvent is pumped over the clothes then drained away.
- Drying evaporates any leftover solvent. The dirty solvent is filtered and re-used.
- New machines use 50% less PERC.

c) Students should circle:

- cleans clothes, but there's nothing dry about it
- I felt pretty dizzy my first week.

Activity Planning Notes

Read the introduction on page 76 together as a class. Direct students to read the cartoon. Help students identify the types of support used for the decision to pack an umbrella by asking them to explain why the example and fact or statistic boxes have been checked off in the clipboard graphic. Have students reinforce their learning by completing and then discussing questions 1 to 4 at the bottom of the page.

Accommodations

- Provide students who need more space to complete question 2 on page 77 with a separate piece of paper they later glue into their student resource.

Have students read the Science and Media Link article on page 77. Consider using an overhead transparency of the article to discuss question 1 after students have had a chance to answer it. Alternatively, answer the question as a whole-class activity.

Have students answer question 2 on page 77. Model how to find points to support an opinion by choosing from the underlined, highlighted, or circled statements in the article. Encourage students to add points of their own. For example, they may consider the cost of dry cleaning, the jobs it creates, or that dry-clean-only clothes tend to cost more.

To wrap up, ask students to answer the question in the title. Lead them to the answer that dry cleaning uses liquids other than water.

Check Your Understanding Answers (page 76)

1. **d)** scientific explanation
2. **c)** fact or statistic
3. **a)** example or experience
4. **b)** expert testimony

Making Connections Answer (page 77)

2. Sample answers:
   - Yes: PERC has serious health side effects; PERC waste pollutes; process not really dry; costs more than regular laundry
   - No: PERC is organic and not flammable; it's best at dissolving stains; waste is reduced and handled responsibly; worth the cost to preserve fabric; dry cleaning stores create jobs

Ongoing Assessment

- Use question 1 on page 77 to assess students' abilities to identify different kinds of support.
- Use question 2 on page 77 to assess students' abilities to state an opinion and provide supporting points.

Technology Links

- For more information on chemicals used in dry cleaning, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Dry Cleaning.
- For more information on PERC, including hazards and alternatives, go to **www.mcgrawhill.ca/books/Se10** and follow the links to PERC.

Alternative Activities

- Present a topical debate and include supporting points. Have students identify the types of support. You might select something from current events or a debate at school.
- Have students research an issue related to chemistry that interests them and look for the different types of support (i.e., expert testimony, scientific explanation, facts and statistics, experience and examples). Brainstorm a list of possible issues. Have students use **BLM 4–1 Back It Up** to help them.

4.3 Colour Chemistry (page 78)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
20 min 45 min for Find Out	• samples of hair dye • chart paper and markers	BLM 4–2 PMI Chart

Specific Expectations

CIM3.02 – analyse the costs and benefits of a specific material with reference to its interactions with other materials in the environment

CIM3.03 – communicate an opinion, supported by evidence, about the use of a particular material, with consideration for both its physical and chemical interactions

Key Terms Teaching Strategies

Have students complete the following activity to help them learn and remember the key terms:

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

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

Reading Icon Answer (page 78)

Students should underline:

- Hair dyeing involves chemical reactions between the colour molecules in hair and parts of the dye.
- Ammonia is a chemical found in many household cleaners.
- Peroxide… breaks the forces that hold together the colour in hair.
- …releases sulfur…
- Ammonia and peroxide are harsh chemicals that dry out hair…

Activity Planning Notes

Show students the samples of hair dye. Do a quick survey to find out the experience of students with hair dyes. Ask volunteers to share why they do or do not use hair dye. Record all of the reasons on the chalkboard or chart paper. You may need to ask probing questions to see if anyone has ever chosen not to do this because of the smell or because of an allergic reaction to the dye.

Read the introduction on page 78 together as a class before having students complete and then discuss questions 2 and 3.

Use the pros and cons that the class brainstormed to help students complete the Find Out activity.

Accommodations

- Pair ESL and LD Learners with students who have stronger language skills. Remind students to refer to their Science Log or the glossary starting on page 316 when they are confused about the key terms.

Check Your Understanding Answer (page 78)

2. ammonia, peroxide

Making Connections Answer (page 78)

3. Sample answer:

- Work in a well-ventilated area or wear an appropriate mask.

Find Out Activity (page 79)

Weigh the Issues

Purpose

- Students apply a cost-benefit analysis by using a PMI chart.

Science Background

Ammonia opens the cuticle of the hair, giving the peroxide access to remove the pre-existing colour by breaking chemical bonds. This step causes the release of sulfur. Sulfur and ammonia account for the bad smells during hair dyeing. The new colour then penetrates the cortex of the hair. Conditioner seals the cuticle and protects the hair colour.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 days before	• Gather samples of hair dye or packaging that show the steps and components. • Photocopy **BLM 4–2 PMI Chart** (optional).

APPARATUS	MATERIALS
• straight arm balance and a set of masses	• sample of a peroxide-free hair dye such as henna (optional)

Suggested Timing

45 min

Activity Planning Notes

In advance, make an overhead transparency of **BLM 4–2 PMI Chart** to help walk students through the process or use it during a follow-up class discussion.

If you haven't already done so, as a class brainstorm the pros and cons of hair dyeing. Read the directions as a class before having students categorize points as positive or negative, and record them in the appropriate columns of the PMI chart.

Since points do not all have equal weight, have students assign a number value to each one. Ask students to assign a positive or negative value to points in the Interesting column.

Have students share some of their points. Record the plus, minus, or interesting points on the overhead transparency. Students may note that dyeing may help a person's confidence or that a person's health (e.g., pregnancy) may have an impact on the decision.

Consider helping students conceptualize the weighing of plusses and minuses by using a straight arm balance and a set of masses to weigh the points recorded on the transparency. If you do this, ask students which way the scale tips. What does this suggest about hair dyeing?

What Did You Find Out? Answers (page 80)

5. a) and **b)** Answers will vary.

6. a) Answers will vary.

b) Answers will vary. Look for evidence that students have considered the balance of plusses and minuses and/or identified points that convinced them.

Activity Wrap-up

- Poll the class results. Ask students to give reasons for their choice.
- Present a couple of peroxide-free hair dyes (usually non-permanent) and have the class evaluate them as an alternative. For example, you might bring in a plant-based treatment such as henna.

Alternative Activity

- Have students use **BLM 4–2 PMI Chart** to evaluate a timely chemical debate.

Accommodations

- Provide students who need more space to fill in the PMI chart with **BLM 4–2 PMI Chart**.
- Students with weak math skills could be paired with students who have stronger skills.

Ongoing Assessment

- Use student work in the Find Out activity to assess their ability to analyze the costs and benefits of hair dyeing with reference to its interactions with other materials.
- Use the answers to question 3 on page 78 to assess students' abilities to apply safety practices.

4.4 Researching Plastics (page 80)

SUGGESTED TIMING

90–100 min including the Science and Media Link
30 min for Try This!
45 min for Find Out: Types of Plastics
30 min for Find Out: Are Plastics Positive or Negative?

MATERIALS

- chart paper and markers
- molecular model kit to illustrate polyethylene
- samples of plastic from each of the seven recycling groups

BLACKLINE MASTERS

Master 2 Writing an Opinion Paragraph
BLM 4–3 It's Up to You
OHT 5 PMI Chart
OHT A–18 Plastics in Your Life
OHT A–19 Types of Plastic
OHT A–20 Plastics, Health, and the Environment
Assessment Master 15 Visual Presentation Checklist
Assessment Master 16 Visual Presentation Rubric

Specific Expectations

CIM3.01 – research the interactions of materials that are used in daily life
CIM3.02 – analyse the costs and benefits of a specific material with reference to its interactions with other materials in the environment
CIM3.03 – communicate an opinion, supported by evidence, about the use of a particular material, with consideration for both its physical and chemical interactions
SIM1.01 – identify the ways in which scientific information is conveyed
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

Key Terms Teaching Strategies

Have students complete the following activity to help them learn and remember the key terms:

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

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

Reading Icon Answer (page 80)

1. There are many examples. Sample answers based on the illustration include:

- computers, TVs, and components
- handles on scissors, knives, pots
- polyester fabric such as bed sheets, blankets, clothes, curtains
- phones, portable music players, CDs and DVDs, cameras
- erasable wall calendars
- window casings
- helmets, knee and elbow pads, joint braces
- skateboards, sleds, skates, skis

Reading Icon Answer (page 84)

1. Students should highlight benefits:

- reduce landfill volume
- take up less space
- weigh less, so it costs less to transport
- lighter shipments mean less gas, thus reducing pollution

Students should circle concerns:

- do not biodegrade
- fill up landfills
- made from oil, which creates many environmental problems
- chemicals can get into our food when it is stored or heated in plastic
- chemicals get into the environment

Activity Planning Notes

This section of the student resource has been designed to use the topic of plastics to bring together all of the previously scaffolded activities. Students will research, create a PMI chart, and write an opinion paragraph about the use of plastics.

Complete and discuss question 1 on page 80 as a class using **OHT A–18 Plastics in Your Life**. Record students' brainstorming on the chalkboard or chart paper for later reference.

Have students complete the Try This! activity to give students an idea of how much we rely on plastics today.

Continue with a bit of background on what makes up a plastic. You may want to use a molecular model kit to make the polymer polyethylene shown on page 81. Show students how the beads of polyethylene can be broken down and put back together to create chains of any length.

Have students complete the Find Out activity on page 82 to provide them with background on different types of plastics and their uses and properties. Students will refer to this research as they complete the chapter.

As a class, scan the media works on pages 84 to 86, then have volunteers present each work to the class. They might role-play the interview or simply read each item aloud. Consider answering question 1 on page 84 as a class. Use **OHT A–20 Plastics, Health, and the Environment** to lead students through this process.

Explain that each media piece presents different arguments. Students should use all of these pieces together to complete the Check Your Understanding questions on pages 85 to 87. Provide students with **Master 2 Writing an Opinion Paragraph** to answer question 2. c) on page 87.

As a class, discuss question 3 on page 87. Encourage students to realize that they need more information. Have students evaluate the pieces for bias. For example, several of the media pieces argue that plastics containing chlorine (and thus, dioxins) should not be used for food storage. If students review the evidence they

Accommodations

- Pair ESL and LD Learners with students who have stronger language skills.
- Have students who have difficulty writing discuss the answers orally.
- Some students may require assistance with research and planning techniques. Pair students with complementary skills.
- Pair students who have difficulties using computers with those who are particularly knowledgable.
- Allow students some choice in choosing a format to present their information for question 7 (e.g., oral report) on page 89.
- If students have access to a computer, they may wish to use clip art and graphics software to create their brochure.

Technology Links

- For a tour of a solid waste management facility, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Where It Goes. The site also explains that new landfills are designed not to biodegrade.
- For an interactive tour of the life cycle of a plastic product, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Life Cycle of a Plastic Product.
- For information about plastic recycling and disposal, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Plastics and the 5 Rs. Check out several topical links.
- For a student-friendly site that features strategies to spot e-myths, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Plastics Myth Buster.
- The American Cancer Society refutes the claim that plastic food containers cause cancer. Go to **www.mcgrawhill.ca/books/Se10** and follow the links to Microwaving Plastic.
- For information about plastics and food storage safety, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Plastics and Food Storage Safety.
- For facts about polystyrene, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Polystyrene.

collected in the chart on page 83, they will find clamshell food containers made from PVC contain chlorine and are used for food.

Scientists have different opinions about the safe use of plastics for food containers. There is not widely accepted research that lets one make a clear-cut judgement. In addition, these media pieces give no consideration to workers who are exposed to dioxins when the plastics are heated during production, fire fighters who are exposed to chemicals during house and industrial fires, or campers exposed to plastics thrown in a camp fire.

Consolidate students' evaluation processes by having them complete the Find Out activity on page 88. You may wish to have students focus on human health concerns, or include points addressing the environment, oil resources, and disposal or recycling issues.

Finish the chapter by having students choose a research topic. Some suggestions have been provided on page 89 of the student resource. Students should use the PMI chart and opinion-forming skills they have practised in order to create their own media piece. Distribute **BLM 4–3 It's Up to You** to help students complete the activity.

You might distribute **Assessment Master 15 Visual Presentation Checklist** and, as a class, read the criteria to help students plan their media piece. Consider having students share the media pieces with their peers or create a visual display for the school.

Consider using the following blackline master and overhead transparencies:

- **Master 2 Writing an Opinion Paragraph**
- **BLM 4–3 It's Up to You**
- **OHT A–18 Plastics in Your Life**
- **OHT A–20 Plastics, Health, and the Environment**
- **Assessment Master 15 Visual Presentation Checklist**

Check Your Understanding Answers (page 81)

2. Synthetic means a substance is not found in nature and must be manufactured.

3. The structure of plastic looks like a string of beads.

Check Your Understanding Answers (page 85)

2. d) All of the above.

3. b) Plastics save space in landfills.

4. glass, ceramic

Check Your Understanding Answers (pages 86–87)

1. Students should circle every kind of support except experience.

2. a) to **c)** Students should state an opinion and provide at least three supporting points.

3. a) and **b)** Look for evidence that students have critically evaluated the arguments presented.

Making Connections Answers (page 89)

7. a) and **b)** Students should summarize at least three costs and benefits.

Try This! Activity (page 81)

Purpose

- Students visit a web site that illustrates how many things in their home are made from plastics.

Science Background

Many students may not be aware of how dependent they are on plastics. There has been an explosion of plastic use in our everyday lives in the last 50 years due mainly to the fact that plastics are practical, versatile, durable, and inexpensive to produce. Resins such as epoxy, polyvinyl chloride, and polyethylene are quite common.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 week before	• Book a computer lab with Internet access.

APPARATUS	MATERIALS
• computer with internet access	

Suggested Timing

30 min

Activity Planning Notes

In advance, book the computer lab. Allow time for students to explore the site on their own before directing their discovery. Have students view the rooms with and without plastic items and list the plastic items that go missing.

Direct students to the web site's glossary, which explains types of plastics. When the site erases plastics from a room, the items disappear. Ask students if this is realistic. Would the items simply not exist, or could they be made from alternative materials?

Have students brainstorm what could be used instead of plastic in these products. Have students consider materials that were used to make these items 50 years ago, before plastics were so pervasive. Consider items such as wooden or bone knife handles, cast-iron frying pans or bathtubs, natural bristles (e.g., boar hair) in hair brushes, ceramic tiles, fabric shower curtains or glass shower doors, glass containers and cups, or chopping boards made from wood, glass, or ceramic. Choose three items from the brainstorm and list the plusses and minuses of each plastic alternative on chart paper.

Encourage students to consider the bias on the web page. What organization designed the page? What message might the organization be trying to convey? How might the page look different if it were created by a logging company or metal manufacturer?

Accommodations

- Pair students who have difficulties using computers with those who are particularly knowledgeable.

Activity Wrap-up

- Have students explore the links on the bottom of the web page. They will find information on plastic production and uses, as well as cross sections of several popular electronics showing their plastic components.

Find Out Activity (page 82)

Types of Plastic

Purpose

- Students research types of plastics, their properties, and uses.

Science Background

In 1988, the Society of the Plastics Industry (SPI) introduced a seven-category resin identification system to assist in the recycling of plastics. Each category has specific properties that make it useful for different purposes.

WHEN TO BEGIN	WHAT TO DO
1 week before	• Ask students to collect plastics with recycling codes 1 through 7. • Collect samples of plastic.
2 days before	• Collect or print resources for students to use.
Day of	• Display plastic samples.

APPARATUS	MATERIALS
	• plastic samples

Suggested Timing

45 min

Activity Planning Notes

A week before, have students start bringing in plastic samples.

Introduce the activity by showing a variety of plastic samples and explain how to find the recycling code.

This classification exercise can be done in groups or as a whole class. Have students sort plastics by code, and then fill in as much of the chart as possible. Use **OHT A–19 Types of Plastic** to get students started by modelling an entry for a sample product.

Have students complete and then discuss question 5 on page 82. You might assign the research as homework, or provide some pre-printed resources for students to use in completing the chart. Information may be available from the municipal government, a recycling agency, or web sites. See the Technology Links below for more information.

Accommodations

- Have students work in pairs or small groups.
- Provide students who need more space to fill in the chart with a photocopy of **OHT A–19 Types of Plastic**.
- ESL and LD Learners could be paired with students who have stronger language skills.

Technology Links

- For research information about plastics, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Types of Plastic.

Find Out Activity Answers (pages 82–83)

4. and **5.** Answers will vary.

6. Sample answers:

Recycling Code and Name of Plastic	Properties	Uses
a) 1; PET or PETE, polyethylene terephthalate	• clear • strong, stiff • doesn't let gas particles through	drink and food containers, insulation in clothing
b) 2; HDPE, high density polyethylene	• translucent • stiff • can be dyed • doesn't react with many chemicals	toys, drainage pipes, recycling bins, floor tiles, shopping bags, bottles for drinks, vitamins, all kinds of soap

c) 3; PVC or V, polyvinyl chloride	• flexible, resilient • solid or foamed • doesn't react with many chemicals • weather-resistant • low flammability • good electric insulator	clamshell-shaped food containers, disposable plates, packing materials, disposable cutlery, bottles for oils and cleaners, binders, film, flooring, cables, siding, medical tubing, pipes
d) 4; LDPE, low density polyethylene	• transparent • strong, flexible • low melting point • good electric insulator	bread bags, lids, frozen food bags, grocery bags, dry cleaning bags, heat sealing bags, six-pack rings
e) 5; PP, polypropylene	• strong • high melting point • best chemical resistance	yogurt and margarine containers, medicine bottles, medical gloves, re-usable water bottles, hangers, woven and knit clothes
f) 6; PS, polystyrene	• brittle, clear, hard • solid or foam • low melting point • good insulator when foamed • very inexpensive	CD cases, grocery store meat trays, egg cartons, cups, plates, household insulation, hangers
g) 7; Other plastics: ABS, melamine, silicon, epoxy	• often a combination of plastics	• ABS: Lego®; heat and dryer vents; outlet covers; boats; models; pet food bowls; vehicle trim and panels • fabrics, computers, electronics, adhesives, plastic lumber

7. Students should circle codes 1, 2, 3, 4, 5, and 6.

8. Answers will vary. For example:

• Plastics are practical, versatile, durable, and inexpensive to produce.

9. Repeated properties include: strong, flexible, solid or foam, good insulator, and chemically resistant.

Activity Wrap-up

- Have students share their findings in a class discussion and fill in any missing points from their charts. Use **OHT A–19 Types of Plastic** to record their findings.
- Have students answer and then discuss questions 7 to 9 on page 83.
- You might have students guess the recycling codes (or type of plastic) of several additional samples. You might structure this as a game show such as *The Price is Right*, pitting individuals or teams against each other.
- Ask students how much plastic they wear. They probably will not find a recycling code on plastic items such as clothes, jewellery, shoes, belts, glasses, and braces.

Find Out Activity (page 88)

Are Plastics Positive or Negative?

Purpose

- Students complete a PMI chart to evaluate the costs and benefits of plastics.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 days before	• Photocopy **BLM 4–2 PMI Chart** (optional).

Suggested Timing

30 min

Activity Planning Notes

As a class, read the directions and make sure everyone understands what to do. Have students work individually or in small groups.

Refer students to the information they collected in Find Out: Types of Plastics on page 82, as well as the Try This! activity on page 81 and the media works presented on pages 84 to 87 to help them.

Get students started by brainstorming plusses and minuses as a class and record their ideas on the chalkboard or an overhead transparency of **BLM 4–2 PMI Chart**.

Accommodations

- Some students may need additional reinforcement to process the information. Such students could be paired with students who have stronger skills.
- Provide individual points on cue cards for students to group manually into plus and minus piles to help them get started.
- Provide students who need more space to record their work with **BLM 4–2 PMI Chart**.

What Did You Find Out? Answers (page 88)

5. and **6.** Answers will vary, depending on student research and ideas.

Activity Wrap-up

- Have students complete and then discuss questions 5 and 6 on pages 88–89. Ask students if they think using plastics is clearly positive or negative. Ask if any other issues surrounding plastics have been in the news lately. You might use the overhead transparency of the PMI chart and add points that students share. Find out if these additional points affect the outcome.
- Have students compare the plus/minus assessment with the opinion they wrote about using plastic food containers on page 87. If the results are different, can both be valid? Discuss this issue as a class.

Alternative Activities

- Have students research the chemical and physical interactions of plastics with different substances. For example, they might report on plastics' reaction with acid or acetone.
- Have students create a poster or pamphlet that features the plusses and minuses of plastics.
- Have students evaluate a chemical-related topic in the news and then outline their opinion using a photocopy of **OHT 5 PMI Chart** and **Master 2 Writing an Opinion Paragraph**.

- Show the film *Peggy Sue Got Married* (Delphi V Productions, 1986). The film has a scene where a 1960s student postulates that plastics are the future and Peggy Sue gives him advice on products to invest in. That student later makes a fortune on his speculation.

Ongoing Assessment

- Provide students with oral and written feedback about their PMI charts and opinion paragraphs to help them improve.
- Have students assess their own performance by writing a journal entry about their experience with developing an opinion and what they learned. Alternatively, allow students to present their ideas orally.
- Use the paragraph that students wrote for question 2 on page 87 to assess their ability to develop a supported opinion.
- Use the PMI Chart that students completed on page 88 to assess their ability to evaluate the plusses and minuses about an issue.
- Assess students' brochures and commercials using **Assessment Master 16 Visual Presentation Rubric**.

Technology Links

- For a Discovery video that features using plants to grow biodegradable plastics, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Plastic-Producing Plants.

Chapter 4 Review (page 90)

SUGGESTED TIMING

30–45 min to complete and take up the review, and then assign the Practice Test

BLACKLINE MASTERS

Master 5 Certificate
Master 6 List of Skills
BLM 4–4 Chapter 4 Practice Test
BLM 4–5 Chapter 4 Test
BLM 4–6 BLM Answers

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.
- As this chapter is skills based, allow students to apply the critical thinking skills to a topic of their choice.
- **BLM 4–4 Chapter 4 Practice Test** can be customized to produce extra reinforcement questions.

Summative Assessment

- Have students complete **BLM 4–5 Chapter 4 Test** to assess individual skills.
- You may wish to develop **Master 5 Certificate** to show students what they have learned during this chapter. Cut and paste the related skills from **Master 6 List of Skills**.

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.

To provide additional reinforcement of key terms, have students make flash cards for all of the new terms they learned in this chapter. Once the review is completed and taken up, assign **BLM 4–4 Chapter 4 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	4.2	Back It Up (page 76)
2	4.2	Back It Up (page 76)
3	4.2	Back It Up (page 76)
4	4.2	Back It Up (page 76)
5	4.2	Back It Up (page 76)
6	4.2	Back It Up (page 76)
7	4.2	Back It Up (page 76) and Where's the Dry in Dry Cleaning? (page 77)
8	Chapter Opener and Find Out activities	Chapter Opener (page 74) and Find Out activities on pages 79 and 88
9	4.2	Back It Up (page 76)
10	Chapter Opener	Chapter Opener (page 74)

Chapter 4 Review Answers (pages 90–91)

1. a) example or experience

2. c) fact or statistic

3. d) scientific explanation

4. b) expert testimony

5. a) F. A doctor interviewed on TV may not be an expert on the topic.

b) T

c) F. It is better to support your opinion.

d) F. All supporting points are not equal.

6. Sample answer:

- The statement explains what is happening based on scientific processes and knowledge.

7. a) Students should underline: seventy percent.

b) Dry cleaning works better on tough stains.

c) No

8. Answers will vary for **a)** and **b)**. Look for one plus, one minus, and one interesting. Sample answers:

a)
- plus: feed plants
- minus: drain into nearby lakes and rivers

b)
- interesting: oxygen in the water gets used up when there are too many plants

9. Answers will vary. Sample answer:

- Chemicals continue to affect people and the environment after they're thrown out and may react negatively with other chemical waste.

10. Answers will vary. Look for one benefit and two costs. Sample answer:

- benefit: removes stains
- costs: cleaning fluids hazardous to workers and environment; expensive/inconvenient

Activity Preparation for Unit A Task

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
Test It! Pop The Top! (page 92) (TR page 113)	• 1 week before – Obtain film canisters from photofinishers. Often, they have full bags awaiting recycling. – Buy effervescent antacid tablets, two per group. • Day of – Set out materials.	• 60–80 min	• Divide the task between two class periods: one for planning, and the next for carrying out the investigations. • Every group will need only the materials and apparatus necessary to change the variable they select. • White film canisters with lids that fit inside make a better seal than the black canisters with the lid that wraps around the rim. • The brand of effervescent tablet is not important, but each group should use only one brand as a further experimental control. • Introduce the activity by demonstrating how the antacid and water will propel the rocket. • You may wish to provide hot and cold tap water rather than having students prepare samples. • Have towels on hand for water clean up.

Materials Needed for Unit A Task

Activity/Investigation	Apparatus	Materials	Blackline Masters
Test It! Pop The Top! (page 92) (TR page 113)	• film canister • mortar and pestle *or* bag and rolling pin • hot plate • metre stick or stopwatch • thermometer • graduated cylinder *or* measuring spoons • beaker	• 2 effervescent antacid tablets • 60 mL water • ice cubes	**Optional** Master 3 Centimetre Grid Paper OHT 3 Centimetre Grid OHT A–8 Identifying Physical Changes and Chemical Changes OHT A–21 to OHT A–23 Test It! Pop the Top!

Unit A Task: Design More Powerful Rocket Fuel (pages 92–97)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
60–80 min for Test It! 40–60 min for Science and Literacy Link	• sample hobby rocket, kit, pamphlets, or instruction manual	OHT 2 Writing an Opinion Paragraph OHT 5 PMI Chart OHT A–8 Identifying Physical Changes and Chemical Changes

Specific Expectations

SIM1.03 – explain how different formats used in the media to present science information target specific audiences
SIM2.01 – formulate testable questions on science-related claims and conduct investigations based on the concept of a fair test
SIM2.04 – organize and communicate information collected from lab investigations and information research using graphic organizers
SIM3.03 – evaluate the investigation and suggest improvements
CIM1.03 – distinguish between chemical reactions and physical processes, using appropriate scientific terminology
CIM1.04 – identify the factors that alter the rate of physical processes and chemical reactions
CIM2.01 – select and use appropriate lab equipment and apply WHMIS safety procedures for the handling, storage, disposal, and recycling of laboratory materials
CIM2.02 – conduct experiments to investigate how materials can interact chemically
CIM2.05 – communicate the results of investigations using a variety of oral, written, and graphic formats
CIM3.02 – analyse the costs and benefits of a specific material with reference to its interactions with other materials in the environment
CIM3.03 – communicate an opinion, supported by evidence, about the use of a particular material, with consideration for both its physical and chemical interactions

Test It! Activity (page 92)

Pop the Top!

Purpose

- Students manipulate one variable affecting the rate of reaction in order to increase the power of "rocket fuel."

Science Background

A film canister is used as a model rocket, powered by the pressure of carbon dioxide generated by the chemical reaction of an effervescing antacid tablet and water.

If students manipulate the amounts of reactants, they may find there is a limit to how fast the top pops off the canister. After a certain point, using more antacid does not speed up the reaction since the pop tops before the antacid is used up. Limiting factors are not part of the curriculum, but may be questioned by students.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 week before	• Obtain film canisters from photofinishers. Often, they have full bags awaiting recycling. • Buy effervescent antacid tablets, two per group.
Day of	• Set out materials.

APPARATUS	MATERIALS
• film canister • mortar and pestle *or* bag and rolling pin • hot plate • metre stick or stopwatch • thermometer • graduated cylinder *or* measuring spoons • beaker	• 2 effervescent antacid tablets • 60 mL water • ice cubes

Suggested Timing

60–80 min

Safety Precautions

- Have students clean up the work area and wash their hands thoroughly with soap and water after completing the activity.
- Encourage students to propel canisters horizontally away from other students, to avoid vertical projectiles and reduce spray.
- Direct students to unplug the hot plate by pulling on the plug, not the cord.

Activity Planning Notes

Introduce this activity by demonstrating how the antacid and water will propel the rocket. Put half an antacid tablet in a film canister that is one-quarter full of water. Lay the sealed canister on the desk so that it will launch horizontally, shielded from students. Set the lid against a launch pad such as a book or wall. In about half a minute the canister will propel over 5 m.

You may wish to divide this task into two class periods. During the first class, have students plan their investigation. As students complete the planning questions, guide them to address procedural issues. You may wish to use **OHT A–21** to **A–23 Test It! Pop the Top!** to help students plan and analyze the results of this activity.

Take up answers to the planning questions and approve all procedures before allowing students to conduct the activity. Some students will need to re-think either procedure if it is not feasible.

Have students work in groups of 2 or 3. Every group will need only the materials and apparatus necessary to change the variable they choose. If they choose to vary the tablets' surface area, they may need only a mortar and pestle. If they vary water temperature, they will need the hot plate, ice, and thermometer. To vary the amount of reactants, they might need a graduated cylinder. Have several sets of each apparatus available.

You may wish to provide hot and cold tap water rather than having students prepare samples. Reaction times differ dramatically.

It is not important to use a specific brand of effervescent tablet. However, each group should use only one brand as a further experimental control.

Review graphing with students. You may wish to complete a sample graph on **OHT 3 Centimetre Grid** using a real set of data. Have students complete and hand in the What Did You Observe and What Did You Discover? questions for evaluation.

Direct student to the flowchart on page 50 or use **OHT A–8 Identifying Physical Changes and Chemical Changes** to help with question 14.

Accommodations

- Students with dexterity problems could be teamed with those who can carry out the tasks.
- It may be more appropriate for some students who have difficulty writing, including ESL learners, to confer with the teacher for this task.
- Provide students who need more space to record their graph with **Master 3 Centimetre Grid Paper**.
- Allow students to use graphing calculators or a spreadsheet program to graph data.

Test It! Answers (pages 92–93)

1. a) reactant; temperature

b) solid; temperature

c) solid; reactant

2. Look for evidence that students have isolated one variable to test.

3. Look for evidence that students have drawn on previous knowledge to make a reasonable prediction based on the question they devised.

4. Look for evidence that students have considered the dangers of the materials and apparatus they are using.

What Did You Observe? Answers (pages 94–95)

7. The mixture fizzed and the rocket flew (or the top popped off).

8. Look for reasonable data.

9. Check that students have accurately graphed the data they recorded.

10. Sample answer for a successful test:

- the reaction sped up, or
- the rocket went farther

11. a) Answers will vary.

b) Look for evidence that students have evaluated their observations.

12. Look for evidence that students have evaluated the investigation and made suggestions for improvement.

13. Look for evidence that students have evaluated the repeatability of the investigation.

14. chemical change

Activity Wrap-up

- Summarize class results on the blackboard and then ask the class to determine the most effective way to get more power out of this effervescent rocket fuel.
- Conduct a single wrap-up test using the class' suggestions. It will likely involve an increase to most variables, (i.e., more and hotter water, and more and smaller tablet chunks for more surface area).
- Increase the aerodynamics of your rocket by creating a shell out of construction paper and a toilet paper tube. Alternatively, tape your fuel canister to a toy car and see how far it will go! Have several groups pit their best results against each other in a race.
- Have students test this reaction using other liquids such as vinegar, lemon, or milk.

Reading Icon Answers (page 96)

1. a) Students should circle these positive points:

- #1 in Safety
- Long shelf life.
- Safer to store and handle.
- Less explosion hazard than liquid fuels.
- No complex pumping and injecting equipment needed.
- Stopping Power! Eject the nozzle for a quick stop.
- Faster acting! Get more power than solid fuel in the same amount of time.
- Control the power easily by changing the fuel mixture.
- Use only as much of the reactants as needed.
- No need to replace expensive nozzles after every launch.
- None of the poisonous heavy metals found in solid fuels. And the exhaust won't contribute to acid rain.

b) Students will read negative implications within the positive statements. They should underline these negative points:

- complex pumping and injecting equipment needed
- replace expensive nozzles after every launch
- poisonous heavy metals found in solid fuels
- exhaust contributes to acid rain

Accommodations

- Encourage students to use dictionaries and edit each other's drafts.
- Review **OHT 2 Writing an Opinion Paragraph** as a class. Alternatively, hand out **Master 2 Writing an Opinion Paragraph** for students to use as a template.
- Allow students with language difficulties to present their opinion orally.

Activity Planning Notes

Discuss hobby rockets, bringing in brochures, an instruction book, or an actual rocket. A few examples of commercial rockets make a good comparison. The Space Shuttle, for example, uses liquid fuel. Ask students which fuel might be more appropriate for a hobby rocket.

The reading check asks students to underline negative statements. Coach them to identify the implied negatives within each positive statement. For example, the packaging contains the statement that solid fuel is "Safer to store and handle." This implies the negative statement that liquid fuel is dangerous to store and handle.

As a class, complete the reading check for the solid rocket fuel media. Have students repeat the procedure on their own for the liquid rocket fuel media. Ask students if they sense a bias in either of the media presented. What is the target audience? How might this affect the claims that are being made?

Guide students through the Check Your Understanding questions by first completing a PMI chart for solid fuel as a class. You may wish to use **OHT 5 PMI Chart**. Then have students complete the PMI chart for the liquid fuel on their own or in pairs. Next, ask the class to choose between solid and liquid fuel, guiding them to their PMI charts for supporting arguments. Students should complete the opinion paragraph singly, using points recorded by the class on the blackboard.

Check Your Understanding Answers (pages 96–97)

2. Solid Rocket Fuel

Plus	Minus	Interesting
• #1 in Safety • Long shelf life. • Safer to store and handle. • Less explosion hazard. • No complex pumping and injecting equipment needed.	• Replace expensive nozzle for every launch. • Uses up all reactants every time. • Poisonous heavy metals. • Exhaust contributes to acid rain.	• Stopping power! • Solid.

3. Liquid Rocket Fuel

Plus	Minus	Interesting
• Faster acting! • Use only as much of the reactants as needed. • No expensive nozzles to replace. • No poisonous heavy metals. • Exhaust won't contribute to acid rain.	• Shorter shelf life. • Dangerous to store and handle. • Requires complex pumping and injecting equipment.	• Control the power easily by changing the fuel mixture. • Get more power than solid fuel in the same amount of time. • Liquid(s).

4. a) to **c)** Students' opinions will vary. Look for evidence that students have supported their opinion with facts from the media works presented.

Ongoing Assessment

- Use the graphs that students make in the Test It! to assess their ability to graph and interpret data. Consider assessing the accuracy of graphs and asking students to explain the results orally.
- Use students' PMI charts to assess their ability to analyse the costs and benefits of a specific material with reference to its interactions with other materials in the environment.
- Use **Assessment Master 8 Safety Rubric** to assess students' safety practices during the Test It!
- Use students' answers to questions 10 and 11 in the Test It! to assess students' abilities to interpret and summarize patterns obtained from graphing data.
- Use **Assessment Master 2 Co-operative Group Work Rubric** to assess how well students worked together during the activity.

Summative Assessment

- Use **Assessment Master 6 Scientific Communication Rubric** to assess the quality of student work during the Test It!
- Use question 14 on page 95 as a formative assessment for knowledge about chemical and physical changes.
- Use questions 1 to 6 on page 93 as a formative assessment of how well students understand effective experimental design.
- Use students' opinion paragraphs to assess their ability to communicate an opinion about the use of a particular material. Opinions should be supported by evidence and show consideration for both physical and chemical interactions.

Technology Links

For more information on rocket fuels, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Rocket Fuel.