Activity Preparation for Chapter 4

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
Test It! Which Metal Is the Best for Pots and Pans? (page 76) (TR page 97)	• 2 to 3 days before – Gather materials. • 1 day before – Photocopy **Master 1 Centimetre Grid Paper** if needed, and any assessment masters you decide to use.	• 75 min	• You may find that the lab proceeds more easily if you create a set of equipment for each group. Include the necessary candles, a strip of each metal, the correct number of tacks, the timer or stopwatch, and the tongs in each lab kit. If you don't have appropriate boxes, you could put the kits in paper bags (the tacks may poke through plastic bags). • Hold each lab group responsible for returning the exact amount of equipment in each lab kit.
Test It! Which Laundry Detergent Is the Best at Removing Stains? (page 81) (TR page 102)	• 2 to 3 days before – Collect substances to make stains, fabric samples, and two types of laundry detergent. – Cut up fabric samples into identical square. • 1 day before – Photocopy **Assessment Master 10 Safety Rubric** and **Assessment Master 14 Fair Test Rubric** and any other assessment masters you decide to use.	• 3 to 5 75-min periods	• Create detergent–water solutions for each of the selected detergents as directed on the package (e.g., 60 mL per 20 L for a typical load — equals 3 mL per L of water). Making this diluted solution for students ensures that they don't use too much detergent. • If you use large beakers for the laundry activity, do not give students glass stirring rods to agitate the laundry. If no wooden sticks or spoons are available, offer metal spatulas.

Materials Needed for Chapter 4

Activity/Investigation	Apparatus	Materials	Blackline Masters
Test It! Which Metal Is the Best for Pots and Pans? (page 76) (TR page 97)	For each group: • timer or stopwatch • tongs	For each group: • wax candle • tea light • matches • 15 cm strips of aluminum, iron, and copper • 9 metal tacks	**Recommended** Master 1 Centimetre Grid Paper OHT 26 Centimetre Grid OHT A–15—A–17 Test It! Which Metal Is the Best For Pots and Pans? Assessment Master 1 Co-operative Group Work Checklist Assessment Master 2 Co-operative Group Work Rubric Assessment Master 9 Safety Checklist Assessment Master 10 Safety Rubric Assessment Master 11 Using Tools and Equipment Checklist Assessment Master 12 Using Tools and Equipment Rubric
Test It! Which Laundry Detergent Is the Best at Removing Stains? (page 81) (TR page 102)	For each group: • large beaker or container with a lid (such as a large yogurt container) • thermometer	For each group: • 2 substances to make stains (such as ketchup, grass, mustard, grape juice, grease from a bicycle chain, motor oil) • 6 identical small squares of fabric • 2 types of laundry detergent • water	**Recommended** OHT A–18—A–20 Test It! Which Laundry Detergent Is the Best at Removing Stains? Assessment Master 10 Safety Rubric Assessment Master 14 Fair Test Rubric **Optional** Assessment Master 9 Safety Checklist Assessment Master 11 Using Tools and Equipment Checklist Assessment Master 13 Fair Test Checklist Assessment Master 15 Oral Presentation Checklist Assessment Master 16 Oral Presentation Rubric

CHAPTER 4 Making Connections to Chemistry (page 76)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
15 min	• pots with different substances on the bottom • 2 types of laundry detergent or stain remover • 2 types of fabric • 2 types of hair mousse or other hair product	Assessment Master 13 Fair Test Checklist Assessment Master 14 Fair Test Rubric

Overall Expectations

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

Activity Planning Notes

Introduce this chapter by showing students a selection of the products they will test (e.g., two different pots, one with a copper bottom and one without; two types of laundry detergent; two types of fabrics).

Have students suggest other products they could test and compare the difficulty of testing different products. For example, what plan would they use to test hair mousse? Would that be easy to do in class time? How would they test and compare two pots?

This chapter allows students to use the skills they developed in the previous chapters to discover what the best product is based on certain tests. This chapter is intricately linked to a common teenage love — shopping!

The two lab activities students complete model the Test It! activities completed in the How to Think Like a Scientist section of the student resource. These lab activities have been developed to introduce the experimental design process to essential level students. You will need to provide students with a lot of guidance during this chapter, as they will need substantial support to ensure success.

Tell students that they will get to test whatever product they like in the Unit Task (within reason). Encourage them to make note of the lab skills they use in the two Test It! activities in this chapter, and encourage them to think about what they want to test and how they will go about it. You might mention that the range of what they test will be much wider if they are willing to provide their own materials and/or give you plenty of advance notice.

Consider using the following blackline masters as you discuss experimental design:

- **Assessment Master 13 Fair Test Checklist**
- **Assessment Master 14 Fair Test Rubric**

The assessment masters for this course cover a range of scientific skills. To avoid duplication, you may wish to focus on some skills in the first investigation, and other skills in the second investigation and/or the unit task. Consider copying and distributing the assessment masters to guide students as they work through each investigation.

4.1 Making Connections in the Kitchen (page 76)

SUGGESTED TIMING

15 min for introduction
75 min for Test It!
20–30 min for Science and Literacy Links

BLACKLINE MASTERS

Master 1 Centimetre Grid Paper
OHT 26 Centimetre Grid
OHT A–15 to OHT A–17 Test It! Which Metal Is the Best for Pots and Pans?
Assessment Master 1 Co-operative Group Work Checklist
Assessment Master 2 Co-operative Group Work Rubric
Assessment Master 9 Safety Checklist
Assessment Master 10 Safety Rubric
Assessment Master 11 Using Tools and Equipment Checklist
Assessment Master 12 Using Tools and Equipment Rubric

Specific Expectations

SIL1.01 – describe how the procedures, skills, and tools employed in different areas of science are also evident in daily life
SIL1.02 – explain the importance of a "fair test" for troubleshooting and testing everyday science problems
SIL2.01 – formulate questions about problems or issues that can be scientifically tested
SIL2.03 – conduct investigations safely, using appropriate lab equipment
SIL2.04 – observe and record data, using a variety of formats, including the use of SI units, where appropriate
SIL2.05 – assess data to make inferences and conclusions and to answer questions and refine procedures
SIL2.06 – communicate plans, observations, and results using a variety of oral, written, and graphic representations, and including the use of SI units, where appropriate
SIL3.03 – demonstrate an understanding of how problem-solving and decision-making activities in the workplace use scientific process skills
CPM1.04 – describe the physical properties of common materials, using appropriate scientific terminology
CPM1.05 – describe the chemical properties of common materials, using appropriate scientific terminology
CPM2.01 – plan and conduct investigations on the physical and chemical properties of substances, using lab equipment and materials safely and accurately
CPM2.02 – use appropriate laboratory safety and disposal procedures while conducting investigations
CPM2.03 – organize and record the observations of the investigations, using appropriate formats
CPM2.04 – interpret and communicate the results of investigations
CPM3.01 – investigate the physical and chemical properties of the component materials of two similar products
CPM3.02 – compare the physical and chemical properties of the materials investigated and relate these properties to how they are used
CPM3.03 – present a recommendation based on the results of the investigation and the research of the product, appropriate for someone interested in using the product

Reading Icon Answer (page 79)

1. Students should underline words that provide information about heat conduction; advantages and disadvantages of various materials; price; the reaction of materials with food

Reading Icon Answers (page 80)

1. These are sample answers. Accept reasonable variations.
– Cindy microwaves coffee at the office and had some explode in her face one day.
– The doctor said that the microwave superheated the coffee and that this is a common accident.
– Superheating happens when a liquid gets very hot without bubbling, as is normal for boiling. Then it can make one huge bubble (explosion).
– Superheating can be prevented by microwaving for two minutes or less, leaving the cup alone for 30 seconds, or putting a stir stick in the cup.

Activity Planning Notes

Ask students how they know something is hot. Can they measure their answers? Now ask them how fast something gets hot. How do they know that? How does the heat move?

Look for ideas that suggest an understanding that heat radiates from a source and moves outward. For example, people sitting the farthest from a camp fire will likely be the last to warm up. Another analogy you could use is spraying perfume in a corner. How long does it take to smell it? Does heat move the same way? Heat does move in a similar way. The perfume molecules are carried along, colliding with molecules as they go, and heat radiates out by passing energy in the form of molecular vibrations and collisions.

You might ask students where the heat goes. Heat dissipates in the air or any other object that touches the hot object. Heat always moves into colder areas or colder materials until, in theory, the temperature is the same everywhere. Use this understanding as an introduction to the Test It! activity.

The Test It! in this section relies on the movement of heat down a linear path — a metal strip. Discuss with students how they can obtain reliable measurements in the investigation. What mistakes might they make? Ask them to read the procedure and brainstorm errors that would make the results less valid, and how to avoid those errors.

Once students have completed and discussed the Test It!, have them read and discuss the two Science and Literacy Links on pages 79 and 80. You may wish to have students work in pairs, with one member of each pair reading a different Science and Literacy Link, and then sharing the information.

Check Your Understanding Answer (page 76)

1. Metals are good conductors of heat.

Check Your Understanding Answers (page 79)

2. Look for information such as the following.

	Heat Conduction	Advantages/Disadvantages	Price	Reaction with Food
a)	heats quickly and evenly	• soft, so scratches and dents easily • not heavy	• cheap, unless treated with enamel or nickel	• reacts with acids from foods such as tomatoes, wine, and lemon juice to affect taste
b)	steady, even heat	• heavy • stains and rusts easily	• cheap, unless treated with enamel or nickel	• rusts when in contact with watery foods • makes food taste rusty
c)	best conductor of heat, heats evenly	• can be poisonous	• expensive	• may dissolve in food

3. Accept all reasonable answers and explanations. All three choices are valid as long as each is backed up with an appropriate reason.

Check Your Understanding Answer (page 80)

2. Answers may include the following precautions.
- Don't heat coffee for longer than two minutes.
- Don't lean over a heated cup.
- Put a stir stick in the coffee.
- Let the coffee sit for 30 seconds after the microwave stops before picking it up.

Test It! Activity (page 76)

Which Metal Is the Best for Pots and Pans?

Purpose

- Students observe and compare the rate of heat conduction in three metals by heating them and timing wax, attached at intervals, as it melts.

Science Background

Heat is conducted when molecules in a material vibrate faster with increased energy and transfer this energy to adjacent molecules by collisions. Thus, heat radiates out from a source. The specific heat of a substance is a value that describes how much energy is required to raise the temperature of a substance.

Metal molecules vibrate faster as they increase in temperature (gain more heat). This heat is transferred to anything touching the metal, such as student fingers (so they should keep their hands clear to avoid burns!) or the wax dots. The wax melts when the molecules in the wax vibrate enough to break the intermolecular bonds that keep the wax solid.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	• Gather materials.
1 day before	• Photocopy **Master 1 Centimetre Grid Paper** if needed, and any assessment masters you decide to use.

APPARATUS	MATERIALS
For each group: • timer or stopwatch • tongs	For each group: • wax candle • tea light • matches • 15 cm strip of aluminum, iron, and copper • 9 metal tacks

Suggested Timing

75 min

Safety Precautions

- Have students clean up the work area and wash their hands at the end of the activity.

Activity Planning Notes

Before beginning the investigation, guide students to read all the way through to page 78 to see the end results they're aiming for.

Have students read the safety precautions. As a class, discuss any additional safety precautions.

Students may have an easier time comprehending the lab if you do it in two parts. Explain the theory and discuss options on the first day, and have students melt the wax and affix the tacks. On the second day, have them heat the strips, and record and analyze their data. You may then have time on the second day to do the Science and Literacy Links, and assign what students don't finish in class as homework.

Discuss the procedure and how to go about it in an orderly fashion. Have lab partners decide on the roles each will have: wax melter and tack pusher to make the strips, holder and timer/recorder as they melt the strips (two students could split the four roles). Discuss how long you want students to have the wax harden for.

Use **OHT A–15** to **OHT A–17 Test It! Which Metal Is the Best for Pots and Pans?** to help students work through the procedure. On the overhead, you might model reading strategies and strategies to keep track of where they are in the procedure. You could tell a story while students are working about how real scientists often scribble notes in the margin about their observations as they work through an investigation. Sometimes, these scribbled observations turn into some amazing discoveries. Scribble some observations on the sides of **OHT A–15** and **OHT A–16 Test It! Which Metal Is the**

Best for Pots and Pans? as you tell this story. Ask students to volunteer observations as they melt the wax and stick the tacks onto the metal strips.

Circulate in the room and offer support while students graph their data. You may want to use **OHT 26 Centimetre Grid** or **OHT A–17 Test It! Which Metal Is the Best for Pots and Pans?** to model graphing techniques. Give students photocopies of **Master 1 Centimetre Grid Paper** if they need more room to work with the graph or to do a rough version of their graph before copying it into their student resource on page 78.

Consider using the following assessment masters to guide students:

- **Assessment Master 1 Co-operative Group Work Checklist**
- **Assessment Master 9 Safety Checklist**
- **Assessment Master 11 Using Tools and Equipment Checklist**

Accommodations

- Some students may freeze up when they see that they are to graph their results. Coax them through gently by introducing them to the checklist. You may want to work through the creation of the graph with a group of students or the whole class *after* they have their data collected.
- Give a copy of **Master 1 Centimetre Grid Paper** to students who need more space than that provided on the grid in the student resource. You may want to use **OHT 26 Centimetre Grid** to model how to make a graph.

Activity Wrap-up

- End the activity by reminding students that the results they obtained with the strips of metal can be applied to real-life applications, such as cooking pots.
- Complete question 15 on page 78 as a class. Ask students to volunteer answers, and discuss the ideas in a constructive and positive manner.

Test It! Answers (pages 76–78)

1. Sample answer: We will try to find out which metal conducts heat the best.

2. Students might choose any of the three metals. Copper is the most likely choice.

Safety Precautions

Answers will vary. Possible answers include:

- Set up all the equipment before beginning the activity because organization reduces accidents.
- Tie back loose hair and clothing.
- Use tongs. Do not grab the metal strips when they are hot. If they start to slip from the tongs, just let the strips fall instead of burning your hand.

3. Accept any three reasonable variables. For example:

- length of each piece of metal
- width of each piece of metal
- distance the metal is held each time from the flame
- height the metal is held
- size of the flame
- type of candle. Students should use the same candle for all trials.
- solidity of the wax (i.e., the hardening time of the wax dots after step 8).

12. Check that the graph has all of the items that are mentioned in the checklist. Have students graph in pencil so they can fix any errors they make in plotting points.

13. a) Answers may vary. For example:

- Use some kind of marker, such as a textbook lined up with a spot 1 inch away from the candle, or a partner watching the holder of the tongs to make sure they keep aligned with the candle or another marker.

b) It's important to do a fair test.

14. A pot made from the same metal as in the strip that heated the quickest.

15. Answers may vary. Look for two tasks for each of fast and slow transfer of heat, and a reason for each. For example:

- fast transfer — cooking food; pots and stovetop burners help cook food fast, which saves on energy costs
- slow transfer — keep hot food hot and cold food cold; a Thermos™ slows down heat loss or heat gain
  — keep pipes and homes warm; insulation helps prevent heat loss and heat gain, which saves on energy costs

Alternative Activities

- You may wish to have students test another product, such as which oil is most viscous or which paper clip design holds papers the best.
  Assist students in developing an investigation along parallel lines to the Test It! presented on pages 76 to 78 of the student resource.
- A "thought experiment" could be conducted as a group game. If handled properly, this game could help develop your class as a cohesive learning group. To do this,
  – Have students *imagine* doing an investigation. In this way, they could choose any size or scope of item that pleases them, for example, an arm for a backhoe bucket or a roof for a circus tent. Have students divide into teams to write procedures for the test and pretend data tables of results. You may wish to provide **Assessment Master 13 Fair Test Checklist** to guide them.
  – Then have students present their thought investigation to the rest of the class and be quizzed on their results. See if other students can find errors that make the thought investigations unfair tests.
  – Depending on the character of your class group, you may want to insist that all comments, challenges, and queries be written on slips of paper and handed to you. Then you can challenge the presenting group with the questions.
  – Consider offering prizes to the group that produces the fairest test or the individuals who come up with the best challenge questions to oral presentations and the best constructive suggestions for groups to make their fair tests better.

Ongoing Assessment

- Consider using **Assessment Master 2 Co-operative Group Work Rubric** to assess students on how well they worked together; **Assessment Master 10 Safety Rubric** to assess students' safety practices; and **Assessment Master 12 Using Tools and Equipment Rubric** to assess students' use of tools and equipment during the investigation.
- Have students assess their own performance. You might offer one or more of the assessment masters listed above. Another good strategy is to have students create a journal entry about
  – their experience with the investigation
  – what they did right
  – what they think they could have done better
  – what they learned.
  Depending on the level of your group, you may ask for full paragraphs with attention to spelling and grammar conventions, or you may ask for point-form notes.

4.2 Making Connections with Clothing (page 81)

SUGGESTED TIMING

10–15 min for introduction
3 to 5 75-min periods for Test It!

MATERIALS

- detergents to be used in the Test It! activity
- vegetable oil
- water
- test tube with stopper

BLACKLINE MASTERS

Master 3 Certificate
Master 4 List of Skills
OHT A–18 to OHT A–20 Test It! Which Laundry Detergent Is the Best at Removing Stains?
Assessment Master 9 Safety Checklist
Assessment Master 10 Safety Rubric
Assessment Master 11 Using Tools and Equipment Checklist
Assessment Master 13 Fair Test Checklist
Assessment Master 14 Fair Test Rubric
Assessment Master 15 Oral Presentation Checklist
Assessment Master 16 Oral Presentation Rubric

Specific Expectations

SIL1.02 – explain the importance of a "fair test" for troubleshooting and testing everyday science problems
SIL2.01 – formulate questions about problems or issues that can be scientifically tested
SIL2.02 – plan, conduct, and refine simple investigations to answer student-generated questions
SIL2.03 – conduct investigations safely, using appropriate lab equipment
SIL2.04 – observe and record data, using a variety of formats, including the use of SI units, where appropriate
SIL2.05 – assess data to make inferences and conclusions and to answer questions and refine procedures
SIL2.06 – communicate plans, observations, and results using a variety of oral, written, and graphic representations, and including the use of SI units, where appropriate
SIL3.01 – develop and investigate research questions about an everyday science-related topic of personal interest
SIL3.02 – evaluate the investigation of the topic they selected and suggest possible refinements
CPM1.04 – describe the physical properties of common materials, using appropriate scientific terminology
CPM1.05 – describe the chemical properties of common materials, using appropriate scientific terminology
CPM2.01 – plan and conduct investigations on the physical and chemical properties of substances, using lab equipment and materials safely and accurately
CPM2.02 – use appropriate laboratory safety and disposal procedures while conducting investigations
CPM2.03 – organize and record the observations of the investigations, using appropriate formats
CPM2.04 – interpret and communicate the results of investigations
CPM3.01 – investigate the physical and chemical properties of the component materials of two similar products
CPM3.02 – compare the physical and chemical properties of the materials investigated and relate these properties to how they are used
CPM3.03 – present a recommendation based on the results of the investigation and the research of the product, appropriate for someone interested in using the product

Science Background

Polar Molecules in Water: Water is a polar molecule. This type of molecule has ends with partial negative and positive charges. The negative end of a water molecule is attracted to and surrounds positive ions or partially positive ends of molecules that are dissolved in water. The positive end of a water molecule is attracted to and surrounds negative ions or partially negative ends of molecules dissolved in water.

Non-Polar Molecules in Oil: Oil is a non-polar molecule that is not soluble in water. That is why water and oil do not mix. Since oil is lighter than water, it floats on water. Most of the oil will accumulate in one glob on the surface. Shaking oil and water together is an attempt to force the oil into a solution. This does not work, which is why it is difficult to wash oily dishes using only water.

Detergent Molecules: Detergent molecules have two very different parts. One component is said to be polar, and the second component is non-polar. The polar part of the molecule is hydrophilic, which means that it is attracted to water. The non-polar part is hydrophobic, which means that it is repelled by water.

Shaking together a mixture of water, oil, and detergent results in the non-polar end of the detergent becoming embedded in the spheres of oil. The small spheres of oil are surrounded by the detergent molecules. The surface of this grease ball is the polar ends of the detergent. These polar ends are attracted to the water. As a result, the grease ball stays suspended in water for a longer period of time.

How does this ability of detergent to keep oil suspended in water result in clean clothes? There are many types of solvents that act as stain removers. When it comes to finding the best solvent, the rule is “like dissolves like.” For example, an acid stain from ketchup can be removed with a soft drink (preferably not one that will leave a stain itself).

Surfactants are another type of stain remover. These help water wet the fabric so the water can surround the stain particles and carry them out of the fabric. The function of surfactants is to dissolve oil and grease from the surface of the clothes and to keep it suspended in the washing water until the water is removed. For example, a surfactant helps remove oil stains from a carpet.

Some stain removers simply “eat” the stain. In this case, oxidizing agents such as chlorine bleach, peroxides, and borax attack the links that hold some of the stain particles together. In other words, they break down the substance.

Stain removers may also try to hide the stain. Some detergents contain “whiteners” that whiten the fabric and do nothing to clean. They contain a material that absorbs ultraviolet light and re-emits it as visible light. To see what this means, shine a black light on your clothes in a darkened room. If the laundry

detergent contains whiteners, your clothes will glow with stain remnants (a trick forensic scientists use to find evidence that was "cleaned up" at a crime scene).

Activity Planning Notes

Introduce the activity by showing the laundry detergents that students will be using in the Test It! investigation. Use the visual at the top of page 81 to discuss how detergents work to remove the stains in our clothes. The triangle shape of the soap emphasizes the "prying" action of soap to remove the dirt from cloth. On the right-hand side, three triangles surround each molecule of dirt, showing the solvating action of soap.

Compare each step and question in the lab write-up with the function of laundry machines. For example, the agitation step where students might choose to shake the cloth in a closed yogurt container is similar to the rotational agitation of laundry machines. Some of your more mechanically minded students may be interested in trying to make their procedures mimic laundry machines as much as possible. For example, they might bring a whisk from their own kitchen and agitate their "laundry" in its container by rotating the whisk in a fixed central position.

Use the Science Background and the Test It! notes to help explain the process to your students. Demonstrate how oil and water do not mix by placing a small amount of each in a test tube, adding a stopper and then shaking vigorously. Next, add some detergent to the test tube. Have students write their observations about how the oil and water will now mix.

Test It! Activity (page 81)

Which Laundry Detergent Is the Best at Removing Stains?

Purpose

- Students practise the skills of planning and conducting an investigation.
- Students observe and record data gathered during the investigation.
- Students are assessed on their ability to communicate their plans and observations in a lab report.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	• Collect substances to make stains, fabric samples, and two types of laundry detergent. • Cut up fabric samples into identical squares. • Create detergent–water solutions for each of the selected detergents as directed on the package (e.g., 60 mL per 20 L for a typical load).
1 day before	• Photocopy any assessment masters you decide to use.

APPARATUS	MATERIALS
For each group: • large beaker or container with a lid (such as a large yogurt container) • thermometer	For each group: • 2 substances to make stains (such as ketchup, grass, mustard, grape juice, grease from a bicycle chain, motor oil) • 6 identical small squares of fabric • 2 types of laundry detergent • water

Suggested Timing

30 min to plan
1 or 2 75-min periods to conduct
1 or 2 75-minute periods to discuss

Safety Precautions

- Remind students to be cautious about handling laundry detergents because such contact can irritate their eyes, lungs, and stomach.
- Encourage gentle agitation of the laundry. Students of this age can easily get out of hand with "agitation" and cause breakage and accidents.
- Have students clean up the work area and wash their hands at the end of the activity.

Activity Planning Notes

Consider using **OHT A–18** to **A–20 Test It! Which Laundry Detergent Is the Best at Removing Stains?** to help students develop a procedure and to review answers. Continue to use the transparencies to work through the lab with the class. Fill in class responses on the overhead transparencies as you go through the lab.

Since this is the second lab design in this chapter, you may wish to let each group test something different (e.g., different fabrics, different detergents, different agitation methods). You could provide a list of three or four tests for the students to choose from if you want to limit the diversity of the class investigations.

Emphasize to students that they must maintain the integrity of the fair test. Provide **Assessment Master 13 Fair Test Checklis**t to guide students in their development of the investigation. You might show **Assessment Master 14 Fair Test Rubric** on an overhead projector and discuss with the class what ideals they are aiming for.

In order to have individual accountability for this evaluation, you may want to have students work by themselves.

Review the safety precautions.

To ensure proper scientific procedure, investigations should test only one variable at a time. For example, compare several detergents under the same conditions (i.e., water temperature and agitation), or a single detergent under various conditions. If a variety of fabrics are tested, the washing conditions and type of stain (e.g., grass) should be the same. Emphasize this while designing the What to Do section.

To show that it is not just the water and agitation doing the cleaning, students should include one control sample that does not use detergent.

Students might choose not to agitate the samples at all, but just let them soak in the solution.

Cotton is most often the fabric selected for this lab. Students could choose another type of fabric to see how well stains are removed from it (e.g., polyester holds onto oil stains really well) and compare their results with those of a group that tested cotton.

Accommodations

- Students who have trouble with reading and writing can still design a lab procedure. You may have to do a lot of the writing and assist students in creating the data table. Or, provide a buddy for those students who have trouble copying down work.
- The voice balloons with the characters on page 82 can be used to help students develop a procedure for this investigation.

- Have students work in pairs or larger groups to complete this activity.
- Provide a list of possible methods for students to use while investigating. Thoroughly discuss and demonstrate the different methods that can be used to ensure the investigation is a fair test.
- Provide a data recording sheet for students to fill in.

Test It! Answers (pages 81–83)

1. Answers will vary. Expect students to ask a question that can be answered by experimentation.

2. Answers will vary. Encourage students to make a prediction and explain why they think the way they do.

3. Encourage students to think through the outline on page 82 and the top of page 83 to develop a procedure.

4. Students may record their observations by collecting the squares of material they stained and washed. Encourage them to develop a method for compiling the squares. For example, they may wish to glue or staple them on a sheet of paper where they label the type of stain and name of detergent. They could use the blank pages at the back of the student resource for this purpose.

5. Encourage students to explain their choice and give details.

6. a) Encourage students to explain in detail the procedures they used for the stain that was most difficult.

b) Encourage students to be creative and thoughtful in finding explanations.

7. Insist that students think of at least one improvement to their procedure. You might use **Assessment Master 9 Safety Checklist**, **Assessment Master 11 Using Tools and Equipment Checklist**, or **Assessment Master 13 Fair Test Checklist** to help students find their errors.

Activity Wrap-up

- Discuss as a class the findings of each group. Ask students how they think they could improve on their procedure. Students will have the greatest difficulty with this, since self-analysis of experimental methods may be new for them. See if the class can come to a consensus on which laundry detergent is the best at removing stains based on all of the group results.
- Have students present their findings to their classmates in a short presentation. Students might use **Assessment Master 15 Oral Presentation Checklist** to guide their efforts. If you use **Assessment Master 16 Oral Presentation Rubric** to assess this skill, inform the students about the assessment categories in advance.

Alternative Activities

- Have students test other products instead of laundry detergent. You may wish to explore
  – what stain removers work best
  – stains in carpets or on ceramic surfaces
  – which product removes stains such as oil or tomato sauce
- Students could conduct a blind test in which they do not know what brands of detergent they are testing. The different brands could simply be labelled "A" and "B." After completing the tests, have students guess which brand is which. This may spark some discussion about advertising in our society and how we start to think of certain brands in a certain way based on advertisements.
- Have students develop a marketing strategy to sell the best stain remover as identified by the investigation. This may be designed in the form of a poster, handout, commercial, or in-store demonstration.
- Develop a display showing the class results. Include stained fabric samples (before and after) as well as an explanation of the procedure and findings.

Ongoing Assessment

- Consider using some of the following assessment masters to assess students' performance during the investigation.
  – Use **Assessment Master 10 Safety Rubric** to assess students' safety practices.
  – Use **Assessment Master 14 Fair Test Rubric** to assess how well students met the criteria for a fair test.

  Provide each student with some oral and written feedback about their performance so they may try to improve.
- You may wish to develop **Master 3 Certificate** to show students what they have learned during this chapter. Cut and paste the related skills from **Master 4 List of Skills**.

Technology Links

- For more information on the history of soaps and detergents, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Soap History.
- For an MSDS on laundry detergent, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Laundry Soap MSDS.

Activity Preparation for Unit A Task

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
Test It! Consumer Product Choices (page 84) (TR page 108)	• 1 week before – Help students do advance preparation and planning for materials. • 1 day before – Photocopy **BLM A–1 Choose and Test a Product Rubric** and any other assessment masters you decide to use.	• 5–10 min	• To reduce time required to help students gather materials, you could choose three or four investigations and have students choose from those. Spend the week or two beforehand gathering what you require.
Try This! (page 87) (TR page 110)	• 1 week before – Book the computer research lab.	• 20 min	• You could make this activity into a one-class research project, or a longer project involving reports and oral presentations.

Materials Needed for Unit A Task

Activity/Investigation	Apparatus	Materials	Blackline Masters
Test It! Consumer Product Choices (page 84) (TR page 108)	• depends on student choices	• depends on student choices	**Recommended** BLM A–1 Choose and Test a Product Rubric OHT A–21—A–24 Test It! Consumer Product Choices **Optional** Assessment Master 2 Co-operative Group Work Rubric Assessment Master 4 Lab Report Rubric Assessment Master 10 Safety Rubric Assessment Master 12 Using Tools and Equipment Rubric Assessment Master 14 Fair Test Rubric
Try This! (page 87) (TR page 110)	• computers for research		

Unit A Task: Choose and Test a Product (page 84)

SUGGESTED TIMING

3–4 h to plan, conduct, and analyze

BLACKLINE MASTERS

BLM A–1 Choose and Test a Product Rubric
OHT A–21 to OHT A–24 Test It! Consumer Product Choices
Assessment Master 2 Co-operative Group Work Rubric
Assessment Master 4 Lab Report Rubric
Assessment Master 10 Safety Rubric
Assessment Master 12 Using Tools and Equipment Rubric
Assessment Master 14 Fair Test Rubric

Specific Expectations

CPM1.03 – explain the characteristics of pure substances and mixtures, using appropriate scientific terminology
CPM1.05 – describe the chemical properties of common materials, using appropriate scientific terminology
CPM2.02 – use appropriate laboratory safety and disposal procedures while conducting investigations
CPM2.03 – organize and record the observations of the investigations, using appropriate formats
CPM2.04 – interpret and communicate the results of investigations.
CPM3.01 – investigate the physical and chemical properties of the component materials of two similar products
CPM3.02 – compare the physical and chemical properties of the materials investigated and relate these properties to how they are used
CPM3.03 – present a recommendation based on the results of the investigation and the research of the product, appropriate for someone interested in using the product
SIL2.01 – formulate questions about problems or issues that can be scientifically tested
SIL2.02 – plan, conduct, and refine simple investigations to answer student-generated questions
SIL2.03 – conduct investigations safely, using appropriate lab equipment
SIL2.04 – observe and record data, using a variety of formats, including the use of SI units, where appropriate
SIL2.05 – assess data to make inferences and conclusions and to answer questions and refine procedures
SIL2.06 – communicate plans, observations, and results using a variety of oral, written, and graphic representations, and including the use of SI units, where appropriate
SIL3.01 – develop and investigate research questions about an everyday science-related topic of personal interest

Test It! Activity (page 84)

Consumer Product Choices

Purpose

- Students design and carry out an investigation to test the properties of a consumer product that interests them.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 week before	• Help students do advance preparation and planning for materials.
1 day before	• Photocopy any needed blackline masters.

APPARATUS	MATERIALS
• depends on student choices	• depends on student choices

Suggested Timing

3–4 h

Safety Precautions


- Have students wash their hands and clean up the work area at the end of the activity.

Activity Planning Notes

Students have completed two similar Test It! activities to prepare them for this culminating activity. It is now time for students to come up with the products and tests they wish to try. Students may need considerable assistance with the planning of the activity. You may want to plan as a whole class, in small groups, or individually, depending on the strengths of your students.

Make sure that students understand the need for advance preparation, and help them plan how to gather materials, or gather materials for them.

Begin by using the overhead transparencies provided for this activity: **OHT A–21** to **OHT A–24**, **Test It! Consumer Product Choices**. As a class, work through an example of a product students could test and the test they could perform. A sample has been provided below to show one way that you could fill in **OHT A–21** to **OHT A–24**, **Test It! Consumer Product Choices**. This sample is compatible with the bubble comments of the cartoon students in the student resource on pages 84 to 87.

If you want students to complete this activity on their own, have them use pages 84 to 87 in their student resource to go through the same process you just modelled for them as a class. As students proceed through the investigation, you may wish to have them follow some of the checklists to help stay on task:

- **Assessment Master 1 Co-operative Group Work Checklist**
- **Assessment Master 3 Lab Report Checklist**
- **Assessment Master 9 Safety Checklist**
- **Assessment Master 11 Using Tools and Equipment Checklist**
- **Assessment Master 13 Fair Test Checklist**

Accommodations

- Provide a "buddy" for those students who have trouble writing.
- Have students work in pairs to complete this activity or share their ideas and plans in groups of four or five.
- Provide a list of possible tests for students.
- Provide a data recording table for the students to fill in or help them develop a data table.

Test It! Answers (pages 84–87)

Note that many other answers are possible and acceptable.

1. fabric

2. To keep water from penetrating so that the contents of a backpack remain dry during a rain storm.

3. Three important properties might include:
- stretchiness
- does not let water through
- strength

4. Possible tests include:
- Test stretchiness by nailing samples to a board and stretching them.
- Test for water resistance by spraying samples with water to see which ones are waterproof.

5. Things to keep the same include:
- the amount of water applied
- the size of the fabric sample
- the temperature of the water
- the angle of the fabric when the water is poured on

6. How much water can a sample handle before the water goes through?

7. Answers will vary. For example:
I think a sample of fabric that is 5 cm by 5 cm will take 25 mL of water before the water will leak through.

8. Work over the sink as water may get on the floor and make it slippery.

9. Look for items such as:
- five samples of different fabrics, each measuring 5 cm by 5 cm
- water
- spray bottle to simulate rain
- graduated cylinder

10.
- Cut five equal-size samples (5 cm by 5 cm) of different fabrics.
- Fill the spray bottle with 25 mL of water.
- Start spraying the first sample of fabric with the water. Complete this step over a sink.
- Watch to see if any water leaks through the fabric. When the water just starts to drip through, stop spraying. Pour the water left in the bottle back into the graduated cylinder.
- Record the volume of leftover water in the data chart. Subtract the leftover amount from 25 mL to see how much water was used.
- Repeat steps for each fabric sample.

11.

Fabric Sample	Amount of Water Left in Bottle	Amount of Water Needed to Wet Fabric
Cotton	15 mL	10 mL
Wool	20 mL	5 mL
Gore-Tex™	did not leak	a lot
Leather	24 mL	1 mL
Nylon/Spandex	18 mL	7 mL

12. I learned that Gore-Tex™ does not let water through.

13. a) Gore-Tex™. If I cannot get Gore-Tex™, I will look for a thick cotton backpack, since cotton was the second-best material in our investigation.

b) I usually look for something that looks good and waterproof. The Gore-Tex™ did not look more waterproof, but it was. So I will consider reading about tests others have done.

Summative Assessment

- Use **BLM A–1 Choose and Test a Product Rubric** to assist you in assessing student work on this task. If you choose to use this rubric, let students know the categories in advance so they can plan well.
- You may also wish to use some of the following assessment masters:
  - **Assessment Master 2 Co-operative Group Work Rubric**
  - **Assessment Master 4 Lab Report Rubric**
  - **Assessment Master 10 Safety Rubric**
  - **Assessment Master 12 Using Tools and Equipment Rubric**
  - **Assessment Master 14 Fair Test Rubric**

Try This! Activity (page 87)

Complete the Try This! activity on page 87 of the student resource. You could make this activity into a one-class research project, or a longer project involving reports and oral presentations. Students are often very interested in consumer products and consumer product testing. The Technology Link provides further media resources to support a longer research activity. To increase student interest in the topic, have a class discussion about what students know about consumer product reporting.

Personal accounts of things that have gone wrong with products are plentiful on the Internet. Emphasize to students that they should rely on official sites by manufacturers or registered consumer groups, and not on every story that is printed on the Internet.

Alternative Activities

- Consumer product testing is a feature of CBC's *Street Cents*. Check the contact information in the Technology Link below.
- If students are stuck for ideas for products to test, suggestions you might make include
  - Which hair dye lasts the longest?
  - Which mascara is most water soluble?
  - Which antiperspirant keeps you drier during exercise?
  - Which skateboard wheels are the fastest?
  - Which hockey sticks are the strongest?

  Note: The curriculum suggests comparing hair mousses and their hold, but this would be a fairly tricky lab for students to get worthwhile results. If they want to compare products such as this, compare gel, mousse, and hairspray. As well, make sure that they have a viable scientific plan for testing the products, either during the class period or by wearing the products and making scientific observations at regular intervals throughout the day.

Technology Links

- To access episodes from CBC's *Street Cents*, go to **www.mcgrawhill.ca/books/Se9** and follow the links to Street Cents.