Grade 5

Cluster 2: Properties of and Changes in Substances

Overview

In this cluster, students deepen their understanding of the characteristics and properties of substances, and the changes that occur in substances in different situations. Through their explorations, students identify the three states of matter—solids, liquids, and gases—and describe the properties of each. Students observe examples of reversible and non-reversible changes, including changes of state. Students also investigate how the characteristics and properties of substances are altered during physical and chemical changes. Students identify examples of these changes in the world around them. Safety practices related to chemical products in the home are addressed. Students evaluate household products by using criteria such as efficiency, cost, and environmental impact.

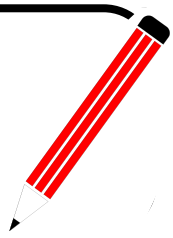
PRESCRIBED LEARNING OUTCOMES
Students will...
5-2-01 Use appropriate vocabulary related to their investigations of properties of, and changes in, substances. Include: characteristic, property, substance, matter, volume, state, solid, liquid, gas, reversible and non-reversible changes, physical change, chemical change, chemical product, raw material. GLO: C6, D3

SUGGESTIONS FOR INSTRUCTION

Teacher Notes

Prior Knowledge

Students have had previous experiences related to this cluster in Grade 3, Cluster 2: Materials and Structures; and in Grade 2, Cluster 2: Properties of Solids, Liquids and Gases.



➢ Introduce, explain, use, and reinforce vocabulary throughout this cluster.

➢ **Word Games**

Use word games (e.g., crosswords, word searches, puzzles) to familiarize students with terms and definitions.

To assist students in developing contextual knowledge of terms, provide them with opportunities to use the terms in new contexts.

SUGGESTIONS FOR ASSESSMENT	SUGGESTED LEARNING RESOURCES

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-02 Identify characteristics and properties that allow substances to be distinguished from one another.

Examples: texture, hardness, flexibility, strength, buoyancy, solubility, colour, mass/weight for the same volume...

GLO: D3, E1

5-0-4c Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 5, 5.2.2)

5-0-4e Use tools and materials in a manner that ensures personal safety and the safety of others. Include: keeping an uncluttered workspace; putting equipment away after its use; handling glassware with care. GLO: C1

5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2

5-0-5f Record and organize observations in a variety of ways. *Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets…* GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-III.2.5)

SUGGESTIONS FOR INSTRUCTION

➢ Describing Substances

Have students identify characteristics and properties (in Grade 5 these terms may be used interchangeably) that need to be considered in describing substances and in distinguishing one substance from another by conducting the following three investigations. Ask students to record their observations in their science notebooks.

Investigation 1

Provide students with two different liquids such as water and oil. Have them identify the similarities and differences between the two substances by observing

- appearance
- feel/texture
- smell

What happens when

- one drop of each substance is placed on a flat surface (e.g., a plate) and then tipped on an angle?
- a paper towel is used to try to absorb the same amount of each substance?

Investigation 2

Provide students with two different solids such as flour and sugar. Have them identify the similarities and differences between the two substances by observing

- appearance (including particle size)
- feel/texture
- mass/weight

What happens when water is added?

Investigation 3

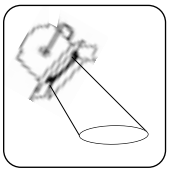
Provide students with two different solids such as a straw and a tongue depressor. Have them identify similarities and differences between the two substances by observing

- appearance
- texture
- hardness
- flexibility
- strength
- buoyancy
- mass/weight

Following the investigations, have students discuss the characteristics and properties they used in the investigations. Record students' responses on a chart and post the chart in the classroom to guide their observations throughout the study of this cluster.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Describing Substances

Provide students with two different solids, such as a pencil and a pipe cleaner. Ask students to compare the two objects in at least five different ways, listing both the similarities and differences.

Look for:

The student compares the substances, considering their

- appearance
- texture
- hardness
- flexibility
- strength
- mass/weight
- purpose or use

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 2)

Observing the Properties of Matter (Video)

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-03 Investigate to determine how characteristics and properties of substances may change when they interact with one other.

Examples: baking soda in vinegar produces a gas; adding flour to water produces a sticky paste...

GLO: C2, D3, E3

5-0-4d Assume various roles and share responsibilities as group members. GLO: C7 (ELA Grade 5, 5.2.2)

5-0-4e Use tools and materials in a manner that ensures personal safety and the safety of others. Include: keeping an uncluttered workspace; putting equipment away after its use; handling glassware with care. GLO: C1

5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2

5-0-5f Record and organize observations in a variety of ways. *Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets…* GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-III.2.5)

5-0-7a Draw, with guidance, a conclusion that explains investigation results. Include: explaining patterns in data; supporting or rejecting a prediction/hypothesis. GLO: A1, A2, C2 (ELA Grade 5, 3.3.4)

SUGGESTIONS FOR INSTRUCTION

➢ **What Changed?**

Have students mix different solids and liquids. Ask them to record the characteristics of the substances individually and then the characteristics of the mixture. Remind them to include their observations of what happened when the substances were combined.

Following the investigations, have students analyze their results and, as a class, develop a conclusion that summarizes their findings. Example: When two substances are mixed together their original characteristics and properties may change.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Extended Response

Provide students with the following:

What Changed?

In your science notebook, describe what changes occur when the following substances are combined:

1. baking soda and vinegar
2. drink mix and water
3. cornstarch and water
4. oil and water

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 1)

Changes in Matter (Video)

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Students will...	
5-2-04 Recognize that matter is anything that has mass/weight and takes up space. GLO: D3 **5-0-7f** Use prior knowledge and experiences selectively to make sense of new information in a variety of contexts. GLO: A2, C4 (ELA Grade 5, 1.2.1)	➢ **Identifying Matter** Introduce the term *matter*. Have students give examples of the three states of matter: solids, liquids, and gases. List their responses on a chart. Example: **States of Matter** **Solids**: • desk • table • pencil **Liquids**: • water • pop • orange juice **Gases**: • oxygen • carbon dioxide • helium Ask students to discuss how the three states are alike. (They all have mass/weight and take up space.)
5-2-05 Identify properties of the three states of matter. Include: solids have definite volume and hold their shape; liquids have definite volume but take the shape of their container; gases have no definite volume and take the volume and shape of their container. GLO: D3 **5-0-4c** Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 5, 5.2.2) **5-0-4e** Use tools and materials in a manner that ensures personal safety and the safety of others. Include: keeping an uncluttered workspace; putting equipment away after its use; handling glassware with care. GLO: C1	➢ **Investigating Matter** Activate students' prior knowledge by having them investigate each state of matter at three different stations. At each station, have students answer the following questions: • Can the shape be changed easily? • Can the volume be changed easily? **Station 1: Solids** Have students observe and investigate a collection of solids to answer the specified questions. Initially, provide solids that retain their shape and volume. After some exposure to these solids, introduce solids such as modelling clay (shape is easily changed) and rice (a collection of individual rice grains can appear to take on the shape of different containers). Have students reflect on whether these substances are solids. **Station 2: Liquids** Provide students with water, food colouring, and several graduated containers of varying shapes. Have students investigate the liquids to answer the specified questions. (Liquids change shape easily. The volume remains constant.) **Station 3: Gases** Provide students with balloons of different sizes. Have students inflate and deflate the balloons to answer the specified questions. (Gases change both shape and volume easily.)

SUGGESTIONS FOR ASSESSMENT	SUGGESTED LEARNING RESOURCES

Extended Response

Provide students with the following:

Defining Matter

You have been asked to explain the term *matter* to a new student in the class. Explain the term using examples.

Look for:

- an accurate definition of the term matter
- an identification of the three states of matter
- examples of each state of matter

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 3)

Restricted Response

Note: This learning experience can be used as an Admit Slip or an Exit Slip. Provide students with the following:

States of Matter

Identify the correct state of matter in each of the following statements:

1. _____ has no definite volume.
2. _____ has a definite volume and holds its shape.
3. _____ takes the volume and shape of its container.
4. _____ has a definite shape but takes on the shape of its container.

Look for:

1. gas
2. solid
3. gas
4. liquid

Measuring Matter (Video)

Observing the Principles of Matter (Video)

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-06 Experiment to compare the mass/weight of a substance in its liquid and solid states.

Examples: compare the mass of ice cubes with the mass of the liquid that results when they melt...

GLO: C2, D3, E3

5-0-1a Formulate, with guidance, specific questions that lead to investigations. Include: rephrase questions to a testable form, focus research questions. GLO: A1, C2 (ELA Grade 5, 3.1.1; Math: SP-I.1.5)

5-0-1b Identify various methods for finding the answer to a specific question and, with guidance, select one to implement. *Examples: generating experimental data; accessing information from a variety of sources…* GLO: C2 (ELA Grade 5, 3.2.2; Math: SP-II.1.5)

5-0-3a Formulate, with guidance, a prediction/hypothesis that identifies a cause and effect relationship. GLO: A2, C2 (Math: SP-I.1.5)

5-0-3b Identify variables that might have an impact on their experiments and, with guidance, variables to hold constant to ensure a fair test. GLO: A2, C2

5-0-3c Create a written plan to answer a specific question. Include: apparatus, materials, safety considerations, steps to follow. GLO: C2 (ELA Grade 5, 3.1.4)

5-0-4a Carry out, with guidance, procedures that comprise a fair test. Include: controlling variables, repeating measurements to increase accuracy and reliability. GLO: C2

5-0-4c Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 5, 5.2.2)

5-0-4d Assume various roles and share responsibilities as group members. GLO: C7 (ELA Grade 5, 5.2.2)

5-0-4e Use tools and materials in a manner that ensures personal safety and the safety of others. Include: keeping an uncluttered workspace; putting equipment away after its use; handling glassware with care. GLO: C1

5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2

5-0-5c Select and use tools and instruments to observe, measure, and construct. Include: balance, thermometer, spring scale, weather instruments. GLO: C2, C3, C5

5-0-5d Evaluate the appropriateness of units and measuring tools in practical contexts. GLO: C2, C5 (Math: SS-I.1.5)

(continued)

SUGGESTIONS FOR INSTRUCTION

➢ Comparing Mass/Weight in Different States

Have groups of students design and then conduct an experiment to answer the following question: Does changing the state of a substance from a solid to a liquid or from a liquid to a gas affect its mass/weight? Students may use "Experiment Report" (BLM 5-K) to record their work.

As a class, begin by identifying the cause and effect components of the question (cause: changing the state of a substance; effect: possible change in mass/weight). The hypothesis that each group develops should be a prediction about this cause and effect relationship.

Examples:

- The mass/weight will not change when a change of state takes place.
- The mass/weight will increase when a substance changes from a liquid to a solid.
- The mass/weight will decrease when a substance changes from a liquid to a solid.

As a class or in small groups, have students identify variables to ensure a "fair test" (e.g., keeping the amount of a substance constant—not losing anything), and develop a plan to carry out the experiment.

Example:

- Brainstorm a list of substances commonly found in solid and liquid states such as water, milk, olive oil, margarine, and chocolate (e.g., miniature chocolate chips).
- Place the substances in individual sealable plastic bags, use a balance to determine the mass of each substance, and repeat measurements to ensure accuracy.
- Freeze or refrigerate the liquids and place the solids in a warm water bath or in sunlight to melt them, and repeat measurements to ensure accuracy.

Ensure that students record their observations in an appropriate format and share their findings as part of a class data chart. This will help identify patterns and any discrepancies in measurement. The class chart should include the following headings:

(continued)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Teacher Notes

Different groups may test different substances, or everyone may work with the same substances. If different substances are used, have more than one group work with each so that students can compare the results (similar to having more than one trial). Groups do not need to work with the same amount of substance as the comparison is mass "before and after"; however, measurement will be easier with larger amounts than with smaller amounts. Ensure that students dry off the bags to remove excess water before reweighing them.

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 8)

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-06 *(continued)*

5-0-5e Estimate and measure mass/weight, length, volume, and temperature using SI and other standard units. GLO: C2, C5 (Math: SS-IV.1.5, SS-III.1.5, SS-I.1.5, SS-VIII.4.3)

5-0-5f Record and organize observations in a variety of ways. *Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets…* GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-III.2.5)

5-0-6c Identify and suggest explanations for patterns and discrepancies in data. GLO: A1, A2, C2, C5

5-0-6f Evaluate the methods used to answer a question or solve a problem. GLO: C2, C3 (ELA Grade 5, 3.3.4)

5-0-7a Draw, with guidance, a conclusion that explains investigation results. Include: explaining patterns in data; supporting or rejecting a prediction/hypothesis. GLO: A1, A2, C2 (ELA Grade 5, 3.3.4)

5-0-7b Base conclusions on evidence rather than pre-conceived ideas or hunches. GLO: C2, C4

5-0-7c Identify, with guidance, a new prediction/hypothesis, based on investigation results. GLO: A1, C2 (ELA Grade 5, 3.3.4)

5-0-9c Demonstrate confidence in their ability to carry out investigations. GLO: C5

5-0-9d Appreciate the importance of creativity, accuracy, honesty, and perseverance as

SUGGESTIONS FOR INSTRUCTION

(continued)

Class Data Chart: Comparing Mass/Weight in Different States	
Substance	
Original State	
Mass/Weight before Change	
Final State	
Mass/Weight after Change	
Difference in Mass	

Have students evaluate, in their science notebooks, the method they used to carry out the experiment and draw a conclusion, using the term *matter* in their writing (e.g., The mass/weight did not change. The amount of matter did not change.).

Refer to page 12 in this document for a description of the stages of scientific inquiry.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Comparing Mass/Weight in Different States

Provide students with the following self-assessment tool:

Self-Assessment of Experiment

1. My prediction/hypothesis was _____
   _____
2. I identified the following variables to hold constant:
   _____
   _____
3. Place a checkmark in the appropriate boxes below.
   - ❑ I made a plan to carry out the experiment.
   - ❑ I followed my plan.
   - ❑ I repeated my measurements so that I know they are accurate.
   - ❑ I recorded my data accurately.
   - ❑ I arrived at a conclusion based on the data collected.
   - ❑ I shared my findings with the class.
4. Next time I would _____
   _____
   _____

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-07 Demonstrate that the mass/weight of a whole object is equal to the sum of the mass/weight of its parts.

Examples: compare the mass/weight of a pencil case and its contents with that of the individual components weighed separately and added together...

GLO: C2, D3, E3

5-0-5c Select and use tools and instruments to observe, measure, and construct. Include: balance, thermometer, spring scale, weather instruments. GLO: C2, C3, C5

5-0-5d Evaluate the appropriateness of units and measuring tools in practical contexts. GLO: C2, C5 (Math: SS-I.1.5)

5-0-5e Estimate and measure mass/weight, length, volume, and temperature using SI and other standard units. GLO: C2, C5 (Math: SS-IV.1.5, SS-III.1.5, SS-I.1.5, SS-VIII.4.3)

5-0-6a Construct graphs to display data, and interpret and evaluate these and other graphs. *Examples: bar graphs, frequency tallies, line plots, broken line graphs…* GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-II.1.5, SP-III.2.5, SP-IV.1.5; TFS: 4.2.2–4.2.6)

5-0-6c Identify and suggest explanations for patterns and discrepancies in data. GLO: A1, A2, C2, C5

SUGGESTIONS FOR INSTRUCTION

➢ Predicting Mass/Weight

Show students a pile of 10 interlocking cubes and an object made from 10 cubes. Ask: Will the pile and the object weigh the same?

Have students give reasons for their prediction, using the term *matter* in their writing. Use a balance to demonstrate that the weights are equal.

➢ Determining Mass/Weight

Provide students with a set of objects that can be taken apart (e.g., an object made with interlocking cubes, a pencil case and contents, a lunch kit and contents). Have students complete these steps:

- Predict the mass/weight of the whole object.
- Find the mass/weight of the whole object.
- Take apart the object and weigh each component part.
- Predict the sum of the mass/weight of each individual part.
- Add up the masses to determine whether the sum equals that of the whole object. (Accuracy in measurement is important.)
- Organize your findings graphically and write a summary statement that includes the term *matter*.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Extended Response

Provide students with the following:

What Is the Mass?

In your science notebook, explain why the mass of a whole apple is the same as the mass of the apple when it is cut into four sections.

Look for:

- the amount of matter does not change when the apple is cut into sections
- because the amount of matter is the same, the mass will be the same

Measuring Matter (Video)

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-08 Demonstrate that changes of state are reversible through the addition or removal of heat.

Include: melting, freezing/solidification, condensation, evaporation.

GLO: D3, E3, E4

5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2

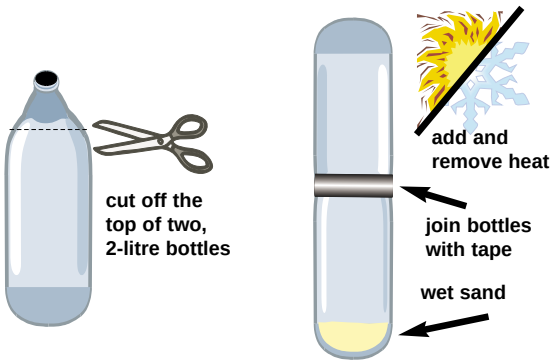
5-0-7f Use prior knowledge and experiences selectively to make sense of new information in a variety of contexts. GLO: A2, C4
(ELA Grade 5, 1.2.1)

SUGGESTIONS FOR INSTRUCTION

➢ Investigating the Addition and Removal of Heat

1. Have students reflect on the Comparing Mass/Weight in Different States learning activity in conjunction with learning outcome 5-2-06. Ask:
   - What did you do to cause the substances to change state? (added or removed heat)
   - Could you make the substances return to their original state?

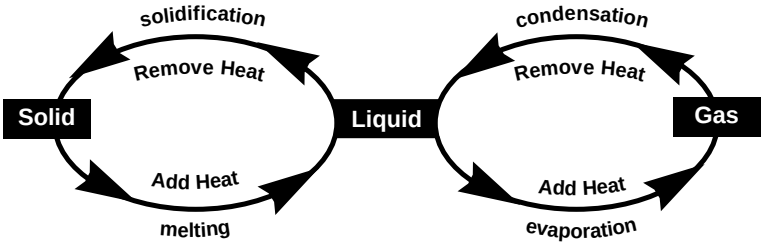
   Introduce the term *reversible change*.
2. Provide students with two 2-litre plastic drink bottles with the tops cut off. Have students put wet sand in the bottom of one bottle. Place the second bottle on top of the first so that the open ends are together, and attach them with strong adhesive tape (e.g., duct tape). Put the bottles in sunlight and have students observe what happens over several hours or days. (Water changes state as it goes through the water cycle.)



Have students summarize what they saw using the following terms: *solid, liquid, gas, melting, solidification, condensation, evaporation, add heat, remove heat, reversible, change of state.*

➢ Changing States

Have students view videos to observe more examples of changes in state. Have students summarize what they have learned about changing states using a diagram (e.g., using red arrows for the addition of heat and blue arrows for the removal of heat).



SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Restricted Response: Changes in States

Provide students with the following:

Changing States

Complete the following statements:

1. Water changes from a liquid to a gas through the _____ of heat. This process is called _____.
2. Water changes from a gas to a liquid through the _____ of heat. This process is called _____.
3. Water changes from a liquid to a solid through the _____ of heat. This process is called _____.
4. Water changes from a solid to a liquid through the _____ of heat. This process is called _____.

Look for:

1. addition, evaporation
2. removal, condensation
3. removal, freezing/solidification
4. addition, melting

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 3)

Changes in Matter (Video)

Exploring Phases of Matter (Video)

How Do They...? Recycle Paper (Video)

How Do They...? Recycle Steel (Video)

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-09 Explore to identify reversible and nonreversible changes that can be made to substances.

Examples: reversible—folding paper, mixing baking soda and marbles; nonreversible—cutting paper, mixing baking soda and vinegar...

GLO: C2, D3, E3

5-0-4c Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 5, 5.2.2)

5-0-4e Use tools and materials in a manner that ensures personal safety and the safety of others. Include: keeping an uncluttered workspace; putting equipment away after its use; handling glassware with care. GLO: C1

5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2

5-0-5f Record and organize observations in a variety of ways. *Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets…* GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-III.2.5)

SUGGESTIONS FOR INSTRUCTION

➢ **Investigating Changes**

Provide small groups of students with a collection of objects/materials (e.g., a rubber band, paper, scissors, modelling clay, an unsharpened pencil, a whole carrot, an ice cube, vinegar, baking soda, marbles, and a balloon). Ask students to change the objects/material in some way and to record the changes made. Have students classify the changes as either reversible or nonreversible and ask them to justify their classification.

Example:

Classification of Changes Made to Substances

Object/ Material	Change Made	Classification: Reversible or Nonreversible	Explanation for Classification
paper	folded it	reversible	can unfold the paper
paper	cut it	nonreversible	cannot put paper back to its original shape without using tape
balloon	popped it	nonreversible	cannot blow up the balloon again because it has a hole
balloon	inflated it	reversible	can let out air, and inflate again
baking soda	added vinegar	nonreversible	cannot separate the baking soda from the vinegar

SUGGESTIONS FOR ASSESSMENT	SUGGESTED LEARNING RESOURCES
Refer to the assessment strategy suggested for learning outcome 5-2-10.	Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 5) *Changes in Matter* (Video) *How Do They...? Recycle Paper* (Video) *How Do They...? Recycle Steel* (Video)

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-10 Recognize that a physical change alters the characteristics of a substance without producing a new substance, and that a chemical change produces a new substance with distinct characteristics and properties.

GLO: D3, E3

5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2

5-0-7a Draw, with guidance, a conclusion that explains investigation results. Include: explaining patterns in data; supporting or rejecting a prediction/hypothesis. GLO: A1, A2, C2 (ELA Grade 5, 3.3.4)

5-0-7b Base conclusions on evidence rather than preconceived ideas or hunches. GLO: C2, C4

5-0-7f Use prior knowledge and experiences selectively to make sense of new information in a variety of contexts. GLO: A2, C4 (ELA Grade 5, 1.2.1)

SUGGESTIONS FOR INSTRUCTION

➢ What Is the Change?

1. Burn a piece of paper and have students observe the result. Ask them to compare and contrast the results with the paper folding in the learning activities suggested for learning outcome 5-2-09.
   - How are the two changes the same? (Both change the appearance of the paper.)
   - How are they different? (New material is produced by burning the paper but not by folding the paper. The folded paper change is reversible but the burned paper change is not.)

   Introduce the terms *physical change* and *chemical change*.

   Ask students whether paper cutting is more like paper folding or paper burning. Have them explain why. (It is more like paper folding because, even though the change is not reversible, no new substance is produced.) Have students label the three changes as physical (no new substances are produced) or chemical (new substances are produced).
2. Bring to class two jars, two dishes, steel wool, and water. Pack the wad of steel wool at the bottom of one jar. In each dish put the same amount of water (2 to 3 cm). Turn the jars upside down and stand them in the dishes.

   Have students observe changes in these objects and materials for one week. Have them identify the initial characteristics, record the changes that occur, and indicate whether the changes are chemical or physical and explain why.

3 Have students view videos to observe more examples of chemical and physical changes.

4. Have students work in small groups to re-examine their chart, Classification of Changes Made to Substances (see instructional strategies suggested for learning outcome 5-2-09) and indicate which changes are chemical and which are physical. Ask each group to join another group and compare designations and justify their answers. Pairs of groups should come to a consensus on their designations. The combined group then repeats the process with another combined group. This can be repeated until a class designation is agreed upon.
5. Have students place a banana on a windowsill to ripen. Have them record the initial characteristics, note the changes that occur, and indicate whether the changes are chemical or physical and explain why. (As the banana ripens it changes from starch to sugar—a chemical change. Tincture of iodine can be used to test for the presence of starch. It turns black if starch is present.)

Suggestions for Assessment

Extended Response

(Learning outcomes 5-2-09 and 5-2-10)

Provide students with the following:

Reversible and Nonreversible Changes

1. Give two examples of reversible changes. Explain why they are reversible.
2. Give two examples of nonreversible changes. Explain why they are nonreversible.
3. Identify your examples as chemical or physical changes. Give reasons to support your classification.

Teacher Notes

Background Information

- *Chemical change* is any change that results in a new kind of matter with a new set of properties. Examples: adding baking soda to vinegar, cooking an egg or any raw food.
- *Physical change* is any change that does not result in a new kind of matter. In a physical change only the shape or appearance of the matter is altered. Examples: boiling water changes it to vapour but it is still water, mixing salt with water.
- *Nonreversible changes* are not always chemical changes and *reversible changes* are not always physical changes. Example: cutting paper is a nonreversible change but it is a physical change, not a chemical one.

Suggested Learning Resources

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 6)

Changes in Matter (Video)

How Do They...? Recycle Paper (Video)

How Do They...? Recycle Steel (Video)

PRESCRIBED LEARNING OUTCOMES
Students will...
5-2-11 Observe examples of changes in substances, classify them as physical or chemical changes, and justify the designation. *Examples: physical—bending a nail, chopping wood, chewing food; chemical—rusting of a nail, burning wood, cooking food...* GLO: C2, D3, E3
5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2 **5-0-5f** Record and organize observations in a variety of ways. *Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets…* GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-III.2.5) **5-0-7a** Draw, with guidance, a conclusion that explains investigation results. Include: explaining patterns in data; supporting or rejecting a prediction/hypothesis. GLO: A1, A2, C2 (ELA Grade 5, 3.3.4) **5-0-7h** Identify, with guidance, potential applications of investigation results. GLO: C4 **5-0-8c** Recognize that technology is a way of solving problems in response to human needs. GLO: A3, B2

SUGGESTIONS FOR INSTRUCTION

➢ Observing Household Changes

Have students observe and record changes that take place in items within their homes. Remind them to take care when observing someone cooking, cleaning, and so on. Ask them to share their data with the class and to classify the changes as chemical or physical. Have students justify their classifications.

Teacher Notes

It may be difficult to differentiate between chemical and physical changes because they often take place at the same time and because students do not have the scientific background needed to analyze the changes taking place.

➢ Home Assignment

As a home assignment, have students, with adult support, bake cookies, bread, or cake. Ask students to compare the batter to the cooked product and identify whether the changes noted are physical, chemical, or both. Have students discuss the science of baking. As a class, brainstorm hobbies that involve science.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Restricted Response

Provide students with the following:

What Is the Change?

Label the following as physical or chemical changes:

1. rusting a nail
2. cutting a piece of paper
3. mixing sugar and water
4. burning a piece of wood
5. sharpening a pencil
6. cooking an egg

Look for:

1. chemical
2. physical
3. physical
4. chemical
5. physical
6. chemical

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 6)

Changes in Matter (Video)

How Do They...? Recycle Paper (Video)

How Do They...? Recycle Steel (Video)

Prescribed Learning Outcomes

Students will...

5-2-12 Identify potentially harmful chemical products used at home, and describe practices to ensure personal safety.

Include: use of products with parental supervision, recognition of safety symbols, procedures to follow in case of an emergency, proper storage of chemical products.

GLO: B1, C1, D3

5-0-2a Access information using a variety of sources. *Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet…* GLO: C6 (ELA Grade 5, 3.2.3; Math: SP-II.3.1)

5-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2

5-0-5f Record and organize observations in a variety of ways. *Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets…* GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-III.2.5)

5-0-8g Describe positive and negative effects of scientific and technological endeavours. Include: effects on themselves, society, the environment, and the economy. GLO: A1, B1, B3, B5

5-0-9e Be sensitive to and develop a sense of responsibility for the welfare of other humans, other living things, and the environment. GLO: B5

Suggestions for Instruction

➢ Household Inventory

Have students, with adult supervision, identify three potentially harmful chemical products used in their homes and determine what safety practices are in place to ensure the safety of family members. Ask students to share their findings with the class and discuss how some products of science and technology have a possible negative impact on humans or the environment.

Teacher Notes

For related learning outcomes and teacher support, refer to General Learning Outcome 3—Safety, in *Kindergarten to Senior 4 Physical Education/Health Education: Manitoba Curriculum Framework of Outcomes for Active Healthy Lifestyles* (2000).

Example:

Household Product Inventory

Product Information

- *Product*: oven cleaner
- *Use*: clean oven

Safety Information on Product

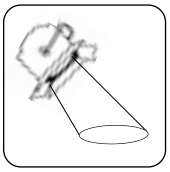
- *Safety Symbols:*
  - — flammable
  - — corrosive
- *Personal Safety:*
  - — Wear gloves and protect arms.
  - — Use in cold oven.
  - — Do not swallow or breathe mist.
- *Proper Storage:*
  - — Store away from all sources of heat (not more than 50°C).
- *What to Do in Case of Emergency:*
  - — If splashed in eyes or on skin, flush with water.
  - — If swallowed, drink three to four glasses of milk or water and call a poison control centre immediately.

Safety Practices at Home

- Store product in locked cupboard.
- Use only with an adult present.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Safety Poster

Provide students with the following:

Safety Poster

Design a poster that shows and describes how to use potentially harmful chemical products safely in the home.

Look for:

- appropriate safety symbols
- a demonstration of the proper storage of chemical products
- a description of what to do in case of an emergency
- an understanding that adult supervision is required when using chemical products

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-13 Evaluate household chemical products using the design process.

Examples: glass-cleaner, laundry soap, toothpaste...

GLO: B5, C3, C4, C8

5-0-1c Identify practical problems to solve. *Examples: How can I determine the mass of air? Which prepared pizza should I buy?…* GLO: C3

5-0-3d Develop criteria to evaluate a prototype or consumer product. Include: function, aesthetics, use of recycled materials, cost, reliability. GLO: C3

5-0-3e Create a written plan to solve a problem. Include: materials, safety considerations, labelled diagrams of top and side views, steps to follow. GLO: C1, C3, C6

5-0-5b Test a prototype or consumer product, using predetermined criteria. GLO: C3, C5

5-0-6e Evaluate the strengths and weaknesses of a consumer product, based on predetermined criteria. GLO: C3, C4

5-0-7d Propose and justify a solution to the initial problem. GLO: C3

5-0-7e Identify new practical problems to solve. GLO: C3

SUGGESTIONS FOR INSTRUCTION

➢ **Product Evaluation: Stain Remover**

Present students with the following scenario:

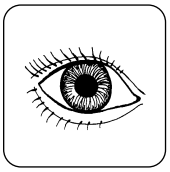
A consumer group has asked you to recommend the best stain remover. Homemade products and commercially made products are to be considered. The group is interested in having the product clean effectively, as well as being safe for the environment, easy to use, and reasonably priced. Conduct your investigation and provide a written report to the consumer group with your recommendations.

Students will need to define clear criteria, determine how to test or gather information related to each criterion, and decide how to make an overall decision. Example: Rate each product as good, fair, or poor for each criterion and then determine which one has the most “good” ratings.

Refer to page 20 of this document for a description of the design process for evaluating consumer products.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Checklist: Product Evaluation

During the Product Evaluation: Stain Remover learning activity, look for indications of the following in student work:

Checklist:

The student

- ❑ identifies the problem
- ❑ identifies the criteria
- ❑ determines the method/procedure for conducting the test
- ❑ tests the product using predetermined criteria
- ❑ analyzes the data
- ❑ arrives at a conclusion

Product Evaluation

Following the Product Evolution: Stain Remover learning activity, provide students with the following self-assessment tool:

I chose to evaluate _____

1. One problem I had was _____
2. One thing I did well was _____
3. If I did this project again I would _____
4. I would still like to learn more about_____

_____

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 10)

PRESCRIBED LEARNING OUTCOMES

Students will...

5-2-14 Research and describe how raw materials are transformed into useful products.

Examples: food processing, oil refining, paper milling, plastic moulding, gold smelting...

GLO: B1, B4, C2, E3

5-0-2a Access information using a variety of sources. *Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet…* GLO: C6 (ELA Grade 5, 3.2.3; Math: SP-II.3.1)

5-0-2b Review information to determine its usefulness, using predetermined criteria. GLO: C6, C8

5-0-2c Record information in own words and reference sources appropriately. GLO: C6 (ELA Grade 5, 3.3.2)

5-0-7g Communicate methods, results, conclusions, and new knowledge in a variety of ways. *Examples: oral, written, multimedia presentations...* GLO: C6 (ELA Grade 5, 4.4.1; TFS: 3.2.2, 3.2.3)

5-0-8c Recognize that technology is a way of solving problems in response to human needs. GLO: A3, B2

5-0-9b Show interest in the activities of individuals working in scientific and technological fields. GLO: B4

SUGGESTIONS FOR INSTRUCTION

➢ **How Are Things Made? (Research Report)**

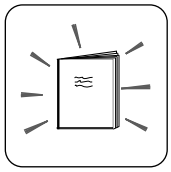
Have small groups of students each select a different product and conduct research to determine the process followed from raw material to final product. Have students present their findings to the class, including an oral description of the process and a labelled diagram.

(For strategies and assessment suggestions to aid students in developing appropriate delivery skills for use in presentations, as well as appropriate public listening and viewing behaviour, refer to *5-8 ELA*, learning outcomes 4.4.1-4.4.3, pp. 383-404.)

➢ **Field Trip**

Take the class on a field trip to observe raw materials being transformed into useful products (e.g., visit the Royal Canadian Mint or a cheese factory).

SUGGESTIONS FOR ASSESSMENT



Peer Assessment: Research Report

Provide students with the following peer assessment tool:

Peer Assessment Rating Scale

Group members: _____

_____

_____

How informative was the report?

1 2 3 4 5

not informative — very informative

How would you rate the presentation format?

1 2 3 4 5

did not keep my attention — kept my attention

Did the students use correct terminology?

1 2 3 4 5

not at all — frequently

Overall, how would you rate the report?

1 2 3 4 5

poor — excellent

SUGGESTED LEARNING RESOURCES

Addison Wesley Science & Technology 5: *Changes in Matter* (Lesson 7)

How Do They...? Recycle Paper (Video)

How Do They...? Recycle Steel (Video)

Notes