Anglophone School District - North

Grade 5 Science - Unit Lesson Guide

Properties and Changes in Materials

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The Aim of Science Education - Scientific Literacy

The aim of science education in the Atlantic Provinces is to develop scientific literacy.

Scientific Literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to develop inquiry, problem-solving, and decision-making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them. To develop scientific literacy, students require diverse learning experiences that provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment.

The Three Processes of Scientific Literacy

An individual can be considered Scientifically Literate when he/she is familiar with, and able to engage in, three processes: Inquiry, problem solving, and decision making.

Inquiry

Scientific inquiry involves posing questions and developing explanation for phenomena. While there is a general agreement that there is no such sing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging science. These activities provide students with opportunities to understand and practise the process of theory development in science and the nature of science.

Problem Solving

The process of problem solving involves seeking solutions to human problems. It consists of proposing, creating, and testing prototypes, products, and techniques to determine the best solution to a given problem.

Decision Making

The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are important to their own right, and they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

Science Assessment Overview

Science is a hybrid term that houses different disciplines such as: Physics, Chemistry, Biology, Environmental Studies, Engineering, Math, etc. Given this broad spectrum, it is not realistic that we can paint science assessment with a single brush in terms of probes that work for every science activity. However, regardless of school subject, let alone science, the frequency of assessment should be unbalanced with formative assessment occupying 80% of practise and summative with the remaining 20%.

80% Formative - 20% Summative

Formative Assessment
Formative assessment is a range of formal and informal assessment procedures employed by teachers during their learning process in order to modify teaching and learning activities to improve student attainment. It typically involves qualitative feedback (rather than scores) for both students and teacher that focuses on the detail of content and performance. Feedback is the central function of formative assessment. It typically involves a focus on the detailed content of what is being learnt.

Science Formative Assessment falls into 2 distinct categories, and they are divided about how feedback is given. Please be aware that an activity could be informal or formal, it is the purpose of the task that determines purpose.

Informal Formative
Informal Formative Science Assessment acts as a monitoring probe and is distinct because it is not graded.

Formal Formative
Formal Formative Science Assessment provides specific feedback to students, the teachers corresponds via anecdotal feedback, rubrics, and written responses to offer progress to student attainment.

Summative Assessment
Summative assessment seeks to monitor educational outcomes, often for the purposes of external accountability. Usually occurring at the end of a learning unit and determines if the content being taught was retained.

Properties and Changes in Materials

Focus and Context

The focus in this unit should be inquiry and investigation. Students should be encouraged to explore a wide range or physical and chemical changes, to investigate how to separate mixtures, and to look closely at the composition of objects around them. One possible context for this unit is household chemistry. Many physical and chemical changes occur as people eat, bake, clean, and repair or renovate the house. Students should relate why they do in this to household events, and inquiry about types of changes that may be occurring, and/or where materials originated.

Unit Instructional Overview

Properties of Materials & Physical Changes*	Chemical Changes	Sources/Masses of Materials in Objects
Access Prior Knowledge	Lesson Activity - Understanding Chemical Changes - Production of Gas	Calculating the Mass of Objects
1st Cycle - Activity - Shape and Volume of Solids and Liquids	Lesson Activity - Understanding Chemical Changes - Change of Properties	Identifying the Sources of Materials of Objects
2nd Cycle - Activity - Testing Properties of Solids and Liquids	Lesson Activity - Understanding Chemical Changes - Reversibility	
3rd Cycle - Activity - Gases (Air)		
4th Cycle - Activity - Changes		

* - EECD Grade 5 Inquiry package - available at https://portal.nbed.nb.ca/tr/lr/k-8Science/Pages/default.aspx

Properties and Changes in Materials - Curriculum Outcomes

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<tr><td></td><td></td><td>204-7, 207-3, 204-5 Work with team members to develop and carry out a plan to systematically distinguish a material based on its chemical properties</td><td rowspan="2">205-8, 300-12 Identify the source of the materials found in an object, and use a variety of methods and technologies to gather information to describe the changes required to the natural materials to create the object</td></tr>
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Properties and Changes in Materials
Strand - Properties of Materials

General Curriculum Outcomes	Specific Curriculum Outcomes
104-7 Demonstrate the importance of using the language of science and technology to communicate ideas, processes, and results	104-7, 300-10 Identify properties that allow materials to be distinguished from one another
300-10 Identify properties such as texture, hardness, colour, buoyancy, and solubility that allow materials to be distinguished from one another	
206-1 Classify according to several attributes and create a chart or diagram that shows the method of classification	206-1, 300-9 Classify materials as solid, liquid, or gases, and illustrate the classification in a chart showing the properties of each material
300-9 Group materials as solids, liquids, or gases, based on their properties	

Strand - Physical Changes

General Curriculum Outcomes	Specific Curriculum Outcomes
301-9 Identify changes that can be made to an object without changing the properties of the material of which it is made	301-9, 205-5 Observe and identify physical changes that affect the form or size of the material in the object without producing any new materials
205-5 Make observations and collect information that is relevant to a given question or problem	
301-10 Identify and describe some physical changes that are reversible and some which are not	301-10 Identify and describe some physical changes that are reversible and some which are not

New Nouveau Brunswick

Be...in this place • Être...ici on le peut

Science Resource Package: Grade 5

Properties and Changes in Materials: Properties of Materials and Physical Changes

New Brunswick Department of Education

December 2010

Instructional Plan

Access Prior Knowledge

✪ Curriculum Outcomes

206-1 Classify according to several attributes and create a chart or diagram that shows the method of classification

Solid, Liquid or Gas Activity

Photocopy the list of words found on page 31 and cut into individual strips.

Have students sort the words into 3 categories: Solid, Liquid, and Gas. Students should work alone then compare how they sorted their words with a partner. Discuss answers as a class. Accept all answers and put a question mark next to those that students cannot agree on.

The table below outlines possible answers. Examples of substances that can be found in multiple states have been included.

For example:

Solid	Liquid	Gas
Iron	Iron?	Hydrogen
Beef Jerky	Vegetable Oil	Oxygen
Chalk	Orange Juice	Air
Desk	Gas?	Gas?
Granite	Milk	Propane
Chocolate	Chocolate?	Helium
Water?	Water	Water?
Ice cream	Ice cream	
Milk?		

At the same time as discussing the sorting (or after if you prefer), ask students:

How do you know if something is a solid, a liquid, or a gas? What characteristics (properties) does it need to have to be a solid? A liquid? A gas?

Cross-curricular links:

ELA

1. Students will be expected to:
   a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
   c) Explain and support personal ideas and opinions

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

Record these ideas on separate pieces of chart paper to revisit at a later time.

A solid is/has	A liquid is/has	A gas is/has

✓ **Assessment:**
Note the concepts and misconceptions students are expressing. You will need to know these to plan effective questions for subsequent activities and discussions so that students will examine and adjust their alternate conceptions.

Post student versions of curricular outcomes on chart paper (see page 29).
Inform students that these outcomes will be addressed over the next portion of the unit. Point out to students which outcomes are being addressed in each activity.

Solid, Liquid or Gas

Iron	Orange Juice	Hydrogen
Beef Jerky	Vegetable Oil	Oxygen
Chalk	Milk	Air
Desk	Ice cream	Helium
Granite	Water	Propane
Chocolate	Gas	
Iron	Orange Juice	Hydrogen
Beef Jerky	Vegetable Oil	Oxygen
Chalk	Milk	Air
Desk	Ice cream	Helium
Granite	Water	Propane
Chocolate	Gas	
Iron	Orange Juice	Hydrogen
Beef Jerky	Vegetable Oil	Oxygen
Chalk	Milk	Air
Desk	Ice cream	Helium
Granite	Water	Propane
Chocolate	Gas	

1st Cycle

✪ Curriculum Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

104-5 Describe how the results of repeated or similar investigations may vary and suggest possible explanations for the variations
104-7 Demonstrate the importance of using the languages of science and technology to communicate ideas, processes, and results
205-3 Follow a given set of procedures
205-5 Make observations and collect information that is relevant to a given question or problem
207-3 Work with team members to develop and carry out a plan
300-9 Group materials as solids, liquids or gases, based on their properties
301-9 Identify changes that can be made to an object without changing the properties of the material of which it is made

ⓘ Teacher note: The shape and volume of gases will be looked at in a later cycle.

Activity – Shape and Volume of Solids and Liquids

Materials:

A variety of containers of different sizes for measuring
Containers of different shapes and sizes for holding liquids and solids
Water
Cubes or other small solids

Have students work in groups to observe what happens to the shape and volume of different materials when they are moved between different containers. Explain that volume is the total amount of space a material takes up.

To reduce the amount of materials necessary, half of the class can work on shape experiments and the other half of the class can work on volume experiments, then the groups can switch.

Shape experiments:

To determine what happens to the shape of materials, provide students with a cup or container with water. They will transfer the water into different sizes and shapes of containers to determine what happens to the shape. For each container, students should draw a picture of what they see and describe what has happened to the shape.

Cross-curricular links:
ELA
2. Students will be expected to:
a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
b) Use word choice and expression appropriate to the speaking occasion

8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record and reflect on experiences and their responses to them

Repeat the experiment using a solid and the same containers. For each container, students should draw a picture of what they see and describe what has happened to the shape.

Volume Experiments:

To determine what happens to the volume of liquids, provide students with a cup or container of water. Ask students to use a ruler to measure the height of the water in the container.

ⓘ Teacher note: If the bottom of the container is raised (i.e. does not sit flat on the table), remind students to measure from the lowest point of the water and not the bottom of the container.

Students will pour the water from one container to another. This should be done for several different sizes and shapes of containers. For each container, ask students to measure and record the height of the water and to decide if the volume of water has changed. Lastly, students transfer the water back to the original cup. Is the water level the same as when they started? (It may be reduced if they have spilled or not completely emptied each container when pouring). Did the volume change when they poured it into different containers?

Students will also test the volume of a solid in different containers. For each container, ask students to observe the solid and to decide if the volume of the solid has changed.

✓ **Assessment:**
During the student activity, make notes on outcomes (or parts of outcomes) you observe being addressed. Process skill outcomes are part of the curriculum and should be assessed. Using the observation chart or the checklist (see pages 34-41) on a clipboard may be helpful to you. Develop your own code for quick notes.

A suggested code:
√ observed and appropriate,
WD with difficulty,
A absent.

This chart may be used on multiple days, using a different coloured pen or pencil each day and putting the date in the corner. You may not have a symbol or note for every child every day. Some teachers like to focus on a group or two each time. However you choose to make note of your observations, you will always have a sense of who you need to take more notice of and who might need extra support. The information will also help you when it is reporting time.

Reflection: Class Discussion

Remind your class about respectful discussion. The discussion tips on pages 26-27 may be helpful.

Solids:

What did you notice about the shape of the solid in the different containers? (Did it change its shape?)

What did you notice about the volume of the solid in the different containers?

Lead students to develop the idea that solids are substances with a definite shape and volume.

Liquids:

What did you notice about the shape of the water in the different containers?

What happened to the volume of the water in the different containers?

Work with students to develop the idea that liquids are substances with a definite volume but no definite shape.

Cross-curricular links:

ELA

1. Students will be expected to:
   a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
   c) Explain and support personal ideas and opinions

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

The animations at http://www.abpischools.org.uk/page/modules/solids-liquids-gases/slg2.cfm?coSiteNavigation_allTopic=1 can be used to summarize the characteristics of solids and liquids. Choose animations 2 and 3.

The video, “Properties of Matter, Part 2 – Liquids, Solids and Gases” from http://learning.aliant.net/ may be useful at this time.

Videos are available free of charge at this site. You will need to register, however registration is free. If you try to watch the video without logging in, you will be prompted to do so. Note that a table of contents opens beside the video so that you may select only certain sections for viewing if you wish. There is also an option to watch the video full screen.

Revisit information on the chart from the Accessing Prior Knowledge activity (on page 4). Ask: *Is there anything that should be added to or revised? Is there other information we could add? Do we need to make changes to our sorted chart of solids, liquids and gases?*

Reflection: Journaling

You have been given a bottle of apple juice and asked to pour it into a fish bowl. What will happen to the shape and volume of the juice?

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record, develop, and reflect on ideas, attitudes, and opinions
- record and reflect on experiences and their responses to them
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

✓ **Assessment:**

Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Take note of whether students can describe that the apple juice will change in shape because it is a liquid, but that it will not change in volume.

🚲 *2nd Cycle*

✪ Curriculum Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

104-5 Describe how the results of similar or repeated investigations may vary and suggest possible explanations for the variations
104-7 Demonstrate the importance of using the language of science and technology to communicate ideas, processes, and results
205-3 Follow a given set of procedures
205-5 Make observations and collect information that is relevant to a given question or problem
206-2 Compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and a bar graph
207-3 Work with team members to develop and carry out a plan
300-10 Identify properties such as texture, hardness, colour, buoyancy, and solubility that allow materials to be distinguished from one another

Students will explore properties that allow materials to be distinguished from one another (solids and liquids) such as solubility, buoyancy, texture, hardness, colour, and so on.

Tell students: *We've talked about the differences between liquids and solids, but how do we tell different solids apart from each other?* (Students will likely identify colour, hardness, texture, smell and maybe a few others).

Sometimes there are solids that look the same, or liquids that look the same. A property is something observable or measurable about a substance that is always the same for that substance, e.g., the freezing point of water. What other properties allow different materials to be distinguished from one another? (Provide students with less familiar properties such as buoyancy, magnetism, solubility, viscosity.)

The following website can be used to help students see how different properties can be tested. These tests and materials are different from what they will be experimenting with but provide a foundation for the activity they will be carrying out.
http://www.bbc.co.uk/schools/scienceclips/ages/7_8/characteristics_materials_fs.shtml

🖐 Activity – Testing Properties of Solids and Liquids

Prepare materials necessary for testing properties of solids and liquids. Materials and suggestions for introducing tests to students can be found in the table below.

Explain that groups will be using different properties in order to compare/contrast various solids and liquids. Quite often, more than one property needs to be tested to identify the solid or liquid.

ⓘ Teacher note: The focus of this activity is for students to observe that not all solids (or liquids) react the same way under the same conditions. While ultimately the goal of testing materials would be to distinguish very similar-looking substances, this activity is about recognizing some properties that can be tested, and that there will be differences in results for different materials. For this purpose, the list of materials does not necessarily contain items that are hard to distinguish.

Identify and demonstrate how to carry out each of the different types of tests. Afterwards, students will be able to choose which tests they would like to carry out and justify why they chose those tests. Suggested tests are given in the following tables.

Tests for solids:

Test	Procedure	Teacher's Notes
Hardness	They may suggest using a nail, a fingernail, or a penny. These are fine if you don't mind having your samples scratched, but they could also be encouraged to try squeezing or bending the samples to decide on the hardness.	Students may remember the hardness test from the Rocks, Minerals & Erosion unit in Grade 4.
Texture	Use fingers to feel texture.	Review words that help describe texture such as smooth, rough, sharp, greasy, cold/hot, etc. It is helpful to create and post a list in the classroom.
Buoyancy	Place the sample in a transparent container with water to determine if the solid completely sinks, completely floats or is somewhere in between.	
Solubility	Mix 10mL (or one piece) in 250mL of water.	This will provide students with an example of how much to use of the solid and water plus what they should be looking for as part of the test.
Smell	Show students how to waft (wave a hand over a container and sniff the air as it wafts towards them) instead of sticking their noses over the sample. Demonstrate how one student will be the test leader while the other students will be blindfolded to test the smells. The test leader allows each member of the group to smell the sample.	

Absorption of liquids	Put material in a dish. Add a small amount of water. Swish it around to allow the material to absorb it. Continue adding small amounts of water until the material has absorbed all it can. Carefully pour the excess back into the water container.	Students need to note the beginning and end amount of water in the “water” container to determine how much has been absorbed. A measuring cup or spoon is not necessary as they could mark the “before” and “after” volumes on their water container.

Tests for liquids:

Test	Procedure	Teacher’s Notes
Texture	Use fingers to feel texture.	Review words that help describe texture such as, greasy, slippery, dry, cold/hot, etc. It is helpful to create and post a list in the classroom.
Buoyancy	Choose one solid. Place the solid in a transparent container with a liquid to determine if the solid completely sinks, completely floats or is somewhere in between.	Students test the same solid in different liquids.
Viscosity	Demonstrate how to pour the liquid from one container to another and decide how “viscous” or sticky it is.	Students will rank their liquids in order of “stickiness”.
Solubility in water	Mix equal amounts of water and the test liquid. Do they mix to form one mixture or stay as two separate liquid layers?	
Smell	Show students how to waft (wave a hand over a container and sniff the air as it wafts towards them) instead of sticking their noses over the sample. Demonstrate how one student will be the test leader while the other students will be blindfolded to test the smells. The test leader allows each member of the group to smell the sample.	

Student Tasks – The sheet *Testing Solids and Liquids* on page 32 may be used by students for predicting and recording observations.

Cross-curricular links:
ELA
2. Students will be expected to:
a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
b) Use word choice and expression appropriate to the speaking occasion

Station 1 – Solids

Materials	Activity	Teacher Notes
Containers, various rocks, blocks, pieces of metal, wood, paper, modelling clay, rubber balls, salt, sugar, baking soda, glass, sponge, fabric, different types of fruit, raisins, etc.	Choose 1 solid. Compare its properties to those of 3 other solids in the pile. Students choose 3 different tests that will help them identify different properties. Students predict what they expect to see before testing.	Each group can choose a different solid to compare to other solids.

Station 2 – Liquids

Materials	Activity	Teacher Notes
Containers (some empty), water, milk, vinegar, table syrup, molasses, cooking oil, rubbing alcohol, pop, cold tea, honey, etc.	Choose 1 liquid. Compare its properties to those of 3 other liquids. Students choose 3 different tests that will help them identify different properties. Students predict what they expect to see before testing.	Each group can choose a different liquid to compare to other liquids.

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

Have a whole class discussion where students can share their results. Did different groups explore different properties even though they had the same substances?

Remind your class about respectful discussion. The discussion tips on pages 26-27 may be helpful.

ⓘ Teacher note: This is an excellent opportunity to talk about differences in results when doing similar activities and fair tests. If groups yield different results, was there something different in the way they carried out their test or in the way they interpreted their observations?

Was there one property tested that proved to be more helpful than others in distinguishing between two similar substances?

Not every solid has the same properties. The same is true for liquids. A substance's properties determine what it can be used for. Provide students with some examples of different solids and ask if they could be used for different things. For example: would a wooden frying pan be useful? Could you use molasses to wipe the kitchen counter clean?

As an example of the importance of considering the properties of a material, the video "Wood Properties and Uses" available at http://learning.aliant.net/ shows how the properties of different types of wood vary. To choose the kind of wood best for a task, its properties must be considered. To access Aliant videos, type the title into the search box.

Videos are available free of charge at this site. You will need to register, however registration is free. If you try to watch the video without logging in, you will be prompted to do so. Note that a table of contents opens beside the video so that you may select only certain sections for viewing if you wish. There is also an option to watch the video full screen.

Cross-curricular links:
ELA
1. Students will be expected to:
a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
c) Explain and support personal ideas and opinions

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

Revisit information on the chart from the Accessing Prior Knowledge activity (on page 4). Ask: *Is there anything that should be added to or revised? Is there other information we could add? Do we need to make changes to our sorted chart of solids, liquids and gases?*

Reflection: Journaling

If you could be a superhero solid or liquid, which would you be? What special properties would you have?

Optional: Extend this by encouraging students to write about why they would not want to be the other form of matter.

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record, develop, and reflect on ideas, attitudes, and opinions
- record and reflect on experiences and their responses to them
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

✓ **Assessment:**

Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

When reading the journal entries, note which students can provide an accurate description of the properties of the state they have chosen.

Possible Extensions:

- Access the webpage below. Have students place different items in the beaker and determine their melting points. Have students graph the results. Students can then be asked to determine what materials would be best for a vessel for cooking different items. Provide the cooking temperatures required. Be prepared to discuss the reasons why various materials would or would not be useful for some tasks – even materials that satisfy the melting point criteria. For example, why couldn't we use a frying pan made from rock?
http://www.bbc.co.uk/schools/ks2bitesize/science/materials/ and click on "Characteristics of Materials". There are also several other animations that support this topic on that web page.

- The animations at http://www.abpischools.org.uk/page/modules/solids-liquids-gases/slg2.cfm?coSiteNavigation_allTopic=1 can be used to explore how the particles of solids, liquids and gases are arranged and behave differently. Choose animation 8.

Testing Solids and Liquids

	Test1 _____		Test 2- _____		Test 3 - _____	
Name of solid	Prediction	Result	Prediction	Result	Prediction	Result

	Test1 _____		Test 2- _____		Test 3 - _____	
Name of liquid	Prediction	Result	Prediction	Result	Prediction	Result

3rd Cycle

✪ Curriculum Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

104-5 Describe how the results of similar or repeated investigations may vary and suggest possible explanations for the variations
104-7 Demonstrate the importance of using the languages of science and technology to communicate ideas, processes, and results
205-3 Follow a given set of procedures
205-5 Make observations and collect information that is relevant to a given question or problem

Weather Unit Outcomes

104-4 Compare the results of their investigations to those of others and recognize that results may vary
104-7 Demonstrate the importance of using the languages of science and technology to communicate ideas, processes, and results
205-4 Select and use tools for measuring
205-7 Record observations using single words, notes in point form, sentences, simple diagrams and charts
206-3 Identify and suggest explanations for patterns and discrepancies in data
300-14 Describe situations that demonstrate air takes up space, has weight, and expands when heated

Ask students if they can think of examples of any gases.

Tell students*: Gases are usually hard to see and they can be difficult to work with. Quite often they are colourless and many are odourless; some dissolve in liquids (like carbon dioxide in pop). Some are toxic, others explosive and they are pretty hard to isolate and use.*

Gases you may be familiar with:

- Chlorine gas which is greenish and irritating to eyes, nose and throat. You may have experienced that irritating sensation at an indoor pool;

-Hydrogen sulphide which is colourless but has a very foul (rotten egg) smell. This smell is added to natural gas to help detect a leak. Some people have natural gas in their homes for heat;

-Propane also has a smell added for safety. It is used for barbecues or for heating homes;

- Ammonia, which is colourless, has a strong, "penetrating" smell. It is found in cleaners like Windex.

Another example that may be familiar is carbon monoxide – you don't know you've been exposed to it except that you get sleepy. CO loves blood cells and crowds out oxygen. Prolonged exposure can be lethal.

To introduce gases, bring a container with hard boiled eggs that have been shelled, a peeled onion or even a piece of orange or lemon. Open the container. Ask students to raise their hands when they smell what is in the container.

(Gases are substances with no definite shape or volume).

We are going to use a gas that we are most familiar with to talk about some properties of gases – air. When we took the lid off of the container, we were experiencing the smell of solids or liquids in air. Relate this to why schools and hospitals are scent-free or if someone eats something smelly, how it can affect everyone around them.

Cross-curricular links:

ELA

2. Students will be expected to:
   a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
   b) Use word choice and expression appropriate to the speaking occasion

8. Students will be expected to:
   a) Use a range of strategies in writing and other ways of representing to
   - record and reflect on experiences and their responses to them

Activity - Gases (Air)

Materials	Procedure	Teacher's Notes
1 balloon 1- 2L bottle	Place balloon within bottle, with the mouth of the balloon pulled over the neck of the bottle. Ask students to attempt to blow up the balloon inside the bottle – can they do it successfully?	
Plastic bottle Bowl or container of water	Have students try to fill up an empty plastic bottle with water by placing it under water sideways in a larger container or bowl of water.	Air bubbles come out of the bottle allowing water to move in.
Ruler or skewer 2 balloons Tape	Have students find two identical balloons. Place the two empty balloons on each end of a ruler. Where is the balancing point? Next, remove and inflate one balloon and re-attach it to the skewer or ruler. Where is the balancing point now? Why?	When one balloon is inflated, the balancing point is not in the middle since air has weight and one balloon has more air/ weight than the other.

Balloon Bowl or container of cold water Hair dryer or warm water String to measure balloon	Inflate a balloon, place it in very cold water, measure the circumference. Students can choose a method for measuring such as using a piece of string, finger lengths, etc. Now using the same balloon, place it in warm water or use a hair dryer to heat it up. Measure the circumference. Why is there a difference?	The balloon will shrink when cooled and expand when heated. At the grade 5 level, students do not need to know about the particles being farther apart when warm and closer together when cooled.

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

Remind your class about respectful discussion. The discussion tips on pages 26-27 may be helpful.

What happened when you tried to fill the plastic bottle with water? Why did that happen? (Air takes up space and there is already a lot of air inside of the bottle). Introduce the word “pressure”. The air inside the bottle takes up space and also pushes or exerts pressure on the bottle so water will not fit inside. Some of the air needs to come out before the water will fit inside.

Where was the balancing point for the two balloons? Why was it not in the middle? (Air has weight)

Why couldn’t you blow up the balloon when it was inside the bottle? Ask them to use the word “pressure”. Ask students if they can come up with a way to successfully inflate the balloon while it still remains inside the bottle. They may need to be led to the idea that the air already in the bottle needs a way to escape so they will need to put holes in the bottle. Some bottles with holes can be ready for them to try so they can see the difference. A nail can be used to put 2-3 holes in the bottom of the bottle. (Air takes up space)

What happened to the size or circumference of the balloon when the temperature changed? (Air expands when heated)

What do you think would happen if we took pure natural gas (methane) and tried to balance it? What about helium?

Where do we find air? (everywhere)

Cross-curricular links:
ELA
1. Students will be expected to:
a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
c) Explain and support personal ideas and opinions

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

Air is a mix of different gases – mostly nitrogen, oxygen and carbon dioxide.

Air has weight, takes up space and expands when heated. It also exerts pressure.

How is air different from solids? Liquids? (It does not have a definite shape or volume).

The animations at http://www.abpischools.org.uk/page/modules/solids-liquids-gases/slg2.cfm?coSiteNavigation_allTopic=1 can be used to summarize the characteristics of gases. Choose animation 6.

Revisit information on the chart from the Accessing Prior Knowledge activity (on page 4). Ask: *Is there anything that should be added to or revised? Is there other information we could add? Do they need to resort the list of solids, liquids and gases?*

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record, develop, and reflect on ideas, attitudes, and opinions
- record and reflect on experiences and their responses to them
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

Reflection: Journaling

You have an "empty" bottle with a cork stuck in the bottle opening. If you heat the bottle, what will happen? Why does this happen?

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

When reading the journal entries, note which students explain the bottle is full of air and will either expand, crack or push the cork out because air takes up space and expands when heated, creating more pressure.

Think like a scientist

Asking good questions is an important skill in science. Initially students will need support. Model the skill with the whole class and students will begin to have the confidence to contribute. After some practice, students will be able to generate questions successfully individually.

Cross-curricular links:
ELA
8a. Students will be expected to:
Use a range of strategies in writing and other ways of representing to
- frame questions and answers to those questions

Present students with a situation and ask them to generate questions that could be investigated scientifically. (These situations and questions do not have to be limited to those that can be done in a classroom.)

Situation:

When new tires are purchased for a car or truck, many of them are now filled with nitrogen instead of air. We are told that tires stay inflated better and last longer when nitrogen is used.

What is one question concerning nitrogen in tires that could be investigated scientifically?

For example:

If two tires are filled with air and two are filled with nitrogen, how will the tire pressure change after a month?
Will the tire pressure change more, from summer to winter, with a nitrogen-filled tire or an air-filled tire?

4th Cycle

✪ Curriculum Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

104-7 Demonstrate the importance of using the languages of science and technology to communicate ideas, processes, and results

205-3 Follow a given set of procedures

205-5 Make observations and collect information that is relevant to a given question or problem

206-1 Classify according to several attributes and create a chart or diagram that shows the method of classification

301-9 Identify changes that can be made to an object without changing the properties of the material of which it is made

301-10 Identify and describe changes to materials that are reversible and some which are not

301-11 Describe changes that occur in the properties of materials when materials interact with each other

301-12 Describe examples of interactions between materials that result in the production of a gas

Weather Unit Outcome

301-13 Relate the constant circulation of water on Earth to the processes of evaporation, condensation, and precipitation

There are 2 types of changes that we can make to substances. One type of change doesn't result in new products/substances. These are physical changes. The other change, a chemical change, is when two or more substances are mixed making new products/substances made of different chemicals/materials from the starting chemicals/materials.

Activity – Changes

As students go through this activity, they should ask themselves and record for each station, "What is this made of?" then do the required activity and ask again of the product, "What is this made of?" Is the result made of different substances/chemicals than those they started with?

Stations can be set up with a selection of the following materials (see table on next page). Stations should be chosen that will show several physical changes and several chemical changes.

Cross-curricular links:

ELA

2. Students will be expected to:
   a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
   b) Use word choice and expression appropriate to the speaking occasion

8. Students will be expected to:
   a) Use a range of strategies in writing and other ways of representing to
   - record and reflect on experiences and their responses to them

Materials	Procedure	Teacher's Note
Pencil Sharpener	Have student sharpen a pencil	Physical change This is still wood and pencil lead, just smaller pieces.
Play dough	Mould the play dough into different shapes	Physical change
Paper Scissors	Cut the paper	Physical change
Paperclips	Bend the paper clip	Physical change
Slime Disposable cup Stir stick Tablespoons or medicine measuring cups (like for baby Tylenol)	Mix 30 mL of the glue solution with 10 mL of the Borax solution and stir.	Chemical change To make glue solution: Mix equal amounts of glue and water. To make Borax solution: Use a 1L bottle and fill the bottom with Borax (found in laundry aisle) to a depth of about ½ -1 cm. Fill the bottle with warm water and shake. Let stand for an hour. Do not shake again even if there is powder left in the bottom. You may pour off the liquid for students or have them use the liquid part without further shaking. The reaction produces slime (not quite a liquid, not quite a solid due to the way the glue and Borax bond together), a material with completely different properties than the starting materials.
Vinegar Baking soda Teaspoon Cup	Mix 2-3 mL of baking soda with 20 mL of vinegar	Chemical change The reaction produces carbon dioxide and water. There will be some vinegar left over as well. The products are different than the starting materials.
Ice cubes with a bit of water	Have students watch the ice cubes melt	Not every group needs "new" ice cubes as long as there is still ice in the cup. This is a physical change. They started with frozen water, ended with water.

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

Remind your class about respectful discussion. The discussion tips on pages 26-27 may be helpful.

Throughout the following discussions, have students fill in a Frayer model about physical change. See sheet on page 33. The following sites give more details on the Frayer model and examples.

http://www.longwood.edu/staff/jonescd/projects/educ530/aboxley/graphicorg/fraym.htm

http://www.tantasqua.org/superintendent/profdevelopment/etfrayermodel.html

Physical vs. Chemical changes

Have students share what they found for each station explaining what the beginning materials were and what materials were present at the end. *Were they made from the same things? Did they have the same properties?* Discussing the state (solid, liquid, or gas) of the starting and ending materials may also help them clarify what is happening.

For example:

- With the pencil and sharpener they started with pencil lead, wood and a sharpener (plastic with a piece of sharp metal) – all solids. They sharpened the pencil and ended with pencil lead, wood and a sharpener. It may look a little different but nothing new was made.
- For the Slime they started with glue and Borax (white powder mixed with water), two liquids. They ended up with something white and slimy that doesn't keep its shape (not really a solid and not really a liquid). It has different properties from glue, Borax and water.
- For the vinegar and baking soda they started with a liquid (clear, smelly) and solid (white powder) and ended with gas (bubbles of

Cross-curricular links:
ELA
1. Students will be expected to:
a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
c) Explain and support personal ideas and opinions

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record , develop, and reflect on ideas, attitudes, and opinions
- record and reflect on experiences and their responses to them
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

carbon dioxide) and a liquid that still smells (vinegar and water). There is no powder left.

Changes of state

For the ice cubes station, ask them if they started with a solid, liquid or a gas. *What is the ice called when it is melted? How would we make water turn into ice? We call the changes from solid to liquid, liquid to solid, liquid to gas and gas to liquid changes of state. These are physical changes. We started with water and froze it, but it is still made with water. Can we make water into a gas?*

When we made slime we called it a chemical change. Why? What if we took our slime and put it in the freezer? What kind of change would that be?

The animations at http://www.abpischools.org.uk/page/modules/solids-liquids-gases/slg2.cfm?coSiteNavigation_allTopic=1 can be used to show examples of change of state. Choose animations 4 and 9.

Reversible vs. irreversible

Sometimes changes are reversible and sometimes they are not.

From the stations explored, which had changes that cannot be reversed? (The pencil shavings cannot be reattached to the pencil as it was before sharpening and the slime cannot be separated back into glue and Borax.

Which had changes which can be reversed? (e.g., a paperclip can be bent back to its original shape, and the water can be changed back to ice –both physical). An example of a chemical change that can be reversed is recharging batteries. It is reversed by adding electricity and the batteries can be used again.

Students can be provided with other examples such as melting crayons or chocolate. In addition, the website http://www.bbc.co.uk/schools/scienceclips/ages/9_10/changing_state_fs.shtml allows students to add or remove heat from a sample of water.

Application of changes of state

One important place that we see water changing states is in nature. Use the following website to very briefly explain how water changing states is related to weather. It evaporates from oceans, rivers and streams and rises into the sky. Then it condenses to form clouds which move to other places. Eventually the clouds lose their water (precipitation) as rain or snow. The water will find its way back to rivers, streams, lakes, etc. ready for evaporation to occur. http://www.athena.bham.org.uk/old/WC.htm

The section *Matter Can Change* from the video, “Properties of Matter, Part 2 – Liquids, Solids and Gases” at http://learning.aliant.net/ may be useful at this time.

Videos are available free of charge at this site. You will need to register, however registration is free. If you try to watch the video without logging in, you will be prompted to do so. Note that a table of contents opens beside the video so that you may select

only certain sections for viewing if you wish. There is also an option to watch the video full screen.

Revisit information on the chart from the Accessing Prior Knowledge activity (on page 4). Ask: *Is there anything that should be added to or revised? Is there other information we could add? Do we need to make changes to our sorted chart of solids, liquids and gases?*

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record, develop, and reflect on ideas, attitudes, and opinions
- record and reflect on experiences and their responses to them
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

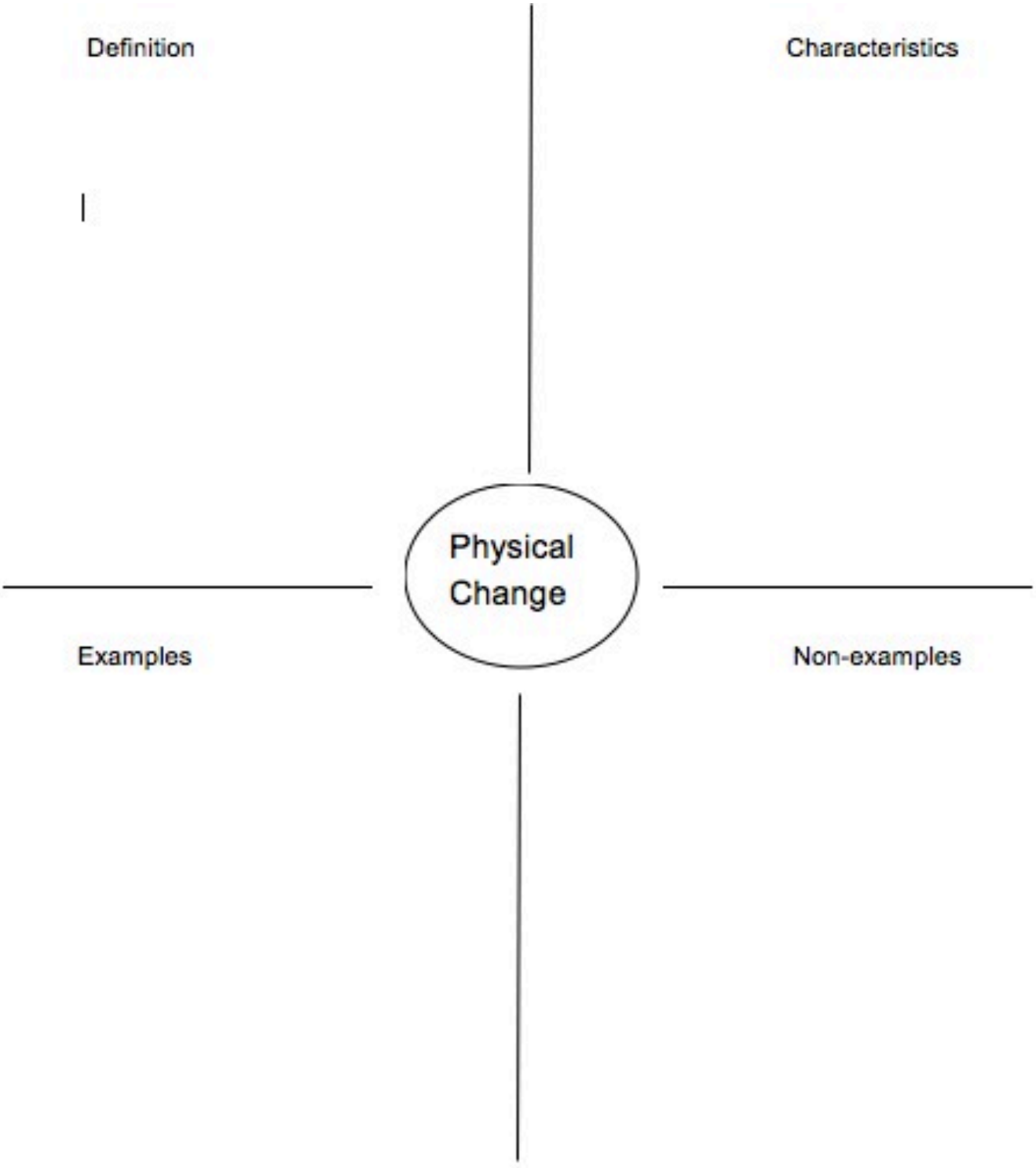
Reflection: Journaling

You start with a balloon filled with air and heat it up. Have you done a chemical or physical change? Why do you think that?

✓ **Assessment:**

Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

When reading the journal entries, note which students can explain the change in terms of whether a new material is created or if it is still the same material.


Definition
Characteristics
Physical Change
Examples
Non-examples

Properties and Changes in Materials
Strand - Chemical Changes

General Curriculum Outcomes	Specific Curriculum Outcomes
301-12 Describe examples of interactions between materials that result in the production of a gas	301-12, 301-11 Describe chemical changes that occur when materials interact with each other to form totally new materials, including those that result in the production of a gas
301-11 Describe changes that occur in the properties of materials when materials interact with each other	
301-10 Identify and describe chemical changes to materials that are reversible and some which are not	301-10 Identify and describe chemical changes to materials that are reversible and some which are not
204-7 Plan steps to solve a practical problem and carry out a fair test of a science-related idea	204-7, 207-3, 204-5 Work with team members to develop and carry out a plan to systematically distinguish a material based on its chemical properties
207-3 Work with team members to develop and carry out a plan	
204-5 Identify and control major variables in investigations	
206-2 Compile an display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs	206-2 Compile and display data that represents the results of chemical tests used to distinguish one material from another

Understanding Chemical Changes - Production of Gas

Outcomes:
• 301-12 describe examples of interactions between materials that result in the production of a gas

Note: Reversibility does not distinguish physical change from chemical change. When different chemicals are mixed in a solution new substances may be formed. However, the addition of more chemicals, application of heat, or stirring may cause the original chemicals to re-form (i.e., to reverse). In other cases, the chemical mixture causes a reaction in which the new substances are strongly bonded and the reaction cannot be reversed.

Lesson Activity Overview:
The curriculum for this section indicates that this lesson deals with knowledge outcomes so the priority should be put on understanding chemical reaction. However, inquiry based demonstrations will be used. For this, students should explore chemical changes of different materials. Many chemical reaction can be done with household chemicals (e.g., vinegar and baking soda). The focus of this lesson should be on chemical reactions producing gases. The simple way to realize the production of gas during a chemical reaction is to make it tangible, but since gas is generally invisible we need to be creative.
Materials - 591ml empty pop bottle (clear is better), regular balloon.
1. Remember the goal is to understand that production of gas and not to experiment with varying quantities to inflate the balloon more.
2. Have students blow into the balloon so that there are not blockages. Let the air out. Place the balloon over the top of the pop bottle and record what it looks like. Then remove the balloon from the pop bottle, be careful to not rip the balloon when removing it.
3. Pour Vinegar into pop bottle (no need to fill the bottle). Be prepared cover the top of the bottle with the balloon once the baking soda has been added (working is pairs makes this task easier). Add a tablespoon scoop of baking soda and cover with the balloon.
4. Students should record observations of what happens to the balloon

Extension
1. Replace baking soda and vinegar with other combinations of acids and bases with the purpose of observing gas production.

Assessment: Informal Formative
Ensure students have recorded observations of the balloon inflating.

Assessment: Formal Formative
Have students answer “What makes the balloon blow up?” on the worksheet. Ensure students are making the connection to acid mixed with base creates a gas.

Understanding Chemical Changes - Production of Gas

Observations Worksheet

Pop Bottle Before adding Baking Soda	Pop Bottle After adding Baking Soda

What makes the balloon blow up?

Exploring Evaporation

Outcomes:
301-12 Describe examples of interactions between materials that result in the production of a gas

Materials:
• Water
• Beaker and/or graduated cylinder (for measuring)
• Small plastic cups
• Plastic plates
• Graph paper
• Markers or pens
• Paper towels
• Desk lamps
• Aluminum foil and/or cookie sheets
• Small fans
• Salt

Inquiry Lesson:
1. Ask students,
    - Have you ever left water out for a period of time:
    - What happened to the water?
    - If it disappeared, where did it go?
    - Do other liquids disappear this way?
    - Do all water sources disappear like this?
    - How about puddles, lakes, streams, seas, and oceans?

   Explain that this process of liquids is called evaporation. Evaporation is the process of a liquids changing into a gas. Ask students,
    - What do you want to know about evaporation?
    - How can we find out more about evaporation?

   Explain that in the upcoming series of exercises they will explore aspects aspects of evaporation.
   The first part of the lesson take a few days, so plan ahead. Begin with the question,
    - How fast does water evaporate?

   Provide student groups with graduated cylinders or beakers, water makers, and a small plastic cup. Have each group mark its cup at the 10, 20, 30, and 40 ml points and fill it with water up to the 40 ml mark. Place all of the groups' cups in an open, but protected, spot in the room. Students should predict how long it will take to for one-fourth (10ml), one-half (20 ml), three-fourths (30 ml), and all (40 ml) of the water in their cups to evaporate. Data can be collected daily and recorded on Activity Sheet More advanced students may graph the results (volume of water on the *y* axis and time on the *x* axis). Ask students,
    - What conclusions did you reach?

- How would you define *evaporation* in your own words?
- Does evaporation seem fast or slow?

2. Ask students,
    - Does heat affect evaporation?

   Direct student groups to place 5 ml of water on two plates. Place one plate on a desk or countertop under a warm lamp or in direct sunlight, and the other on a desk or countertop away from the lamp and direct sunlight. Have students predict which sample will evaporate first. Students can record the actual time for each plate of water to evaporate and display the data in a bar graph.
   Hydrogen bonds between the molecules in water tend to hold the water together and keep it from evaporating quickly. Heat breaks the bonds between the liquid molecules, allowing them to break free and evaporate in the air. The more heat, the more evaporation. Ask students to think of several examples of evaporation in real life. Ask,
    - What is the source of heat that causes evaporation in the case of each example?

3. Now ask,
    - What else might affect evaporation?

   Have student groups place 5 ml of water in small plastic cups and another 5 ml of water on a cookie sheet or sheet of aluminum foil. Ask,
    - Which will evaporate faster?

   Students can record the time needed for each source of water to evaporate and display the data in a bar graph. Ask students to analyze their results and thinnk about what the results show.
   Surface area is connected to evaporation rate. If the surface area is great, more water molecules are exposed to heat and more water molecules can escape from the liquid. Therefore, the greater the surface area, the greater the rate of evaporation. Anyone with long hair will tell you that it takes much longer to dry if it is tied up in a braid as opposed to being spread out over the shoulders.

4. Ask students,
    - Could any other factor significantly affect evaporation?

   Have students groups place 5 ml of water into each of two plates and place one plate in front of a small fan and the other somewhere else (not in front of a fan).
   Ask,
    - Which will evaporate faster?

   Again, students can record the time needed for each source of water to evaporate and display the data in a bar graph. Ask,
    - What do these results indicate?

   Moving air (wind) clearly affects evaporation. The wind blows away the escaping water molecules, allowing more water molecules to warm and escape. More wind means more evaporation. To return to the hair drying example, remember that wet hair dries faster in a moving car with the windows down than it does indoors.

5. Most of the world's water is salty, so students might wonder, *What happens when saltwater evaporates?* Mix a tablespoon of salt into 50 ml of water and have student groups place 5 ml of the mixture onto small sheets of aluminum soil. Aloow the water to evaporate completely (you could challenge students to try to speed up the evaporation rate as much as possible using what they have learned about heat, surface area, or moving air). The while residue left behind is the salt, because it cannot evaporate into the air with the water. When salty ocean or seawater evaporates, therefore, the salt stays behind.

6. Ask the class what they learned about evaporation in these exercises. List their responses on the board. Ask,
    - Why is evaporation important?

   Encourage student responses. Explain that the chemical process we call evaporation is important to living things. You can feel its cooling effect, for instance, by wetting your arm and blowing air over it. Evaporation is also important part of the water cycle, which keeps all the Earth's plants and animals alive. The water cycle also is the basis for climate and weather. Ask students,
    - Which has a greater rate of evaporation, a deep lake or a shallow lake?
    - A cool sea or a warm sea?
    - A hot desert or a cool prairie?
    - How might evaporation affect an area's humidity and temperature?
    - Why do we find monsoons and hurricanes mainly in tropical regions?

   Many questions come to mind regarding evaporation. Find our what your students would like to know, and encourage them to investigate further.

Extension:

1. Encourage students to explore the role of condensation in the water cycle. for example, place ice water in a metal cup and have students observe the water condensing on the cup's outer surface. Can students explain its source? Refer to the water cycle diagram

2. Challenge students to learn more about evaporation's effect on weather and climate in the local region.

Discussion Questions:

1. How can we slow down the rate of evaporation? How can we speed it up?

2. How might oceans affect the area's climate and weather?

3. Why don't the oceans eventually evaporate completely?

Assessment:

1. Could students provide a definition for evaporation in their own words, as well as discuss its general effect on climate and weather? (Use observational, embedded evidence from all procedures as performance assessment. Also, use Discussion Question 2 as a prompt for a science journal entry.)

2. Were students able to successfully graph, analyze, and draw conclusions from their data regarding variables that affect evaporation? (Use observational, embedded evidence form Procedures 2-4 as performance assessment. Also use Discussion Question 1 as a prompt for a science journal entry.)

3. Do students understand evaporation's place in the water cycle? (Use feedback during Procedure 6 as embedded evidence, or use Discussion Question 3 as a prompt for a science journal entry.)

Rubric:

	Developing 1	Proficient 2	Exemplary 3
Could students provide a definition for evaporation in their own words, as well as discuss its general effect on climate and weather?	Attempted but were unable to successfully define or discuss	Successfully defined evaporation and discussed its effect on climate and weather	Successfully defined evaporation and used that definition to extensively discuss its effect on climate and weather
Were students able to successfully graph, analyze, and draw conclusions from their data regarding variables that affect evaporation?	Attempted to utilize their data but were unsuccessful	Successfully graphed, analyzed, and drew basic conclusion from their data regarding variables affecting evaporation	Successfully graphed, analyzed, and drew extensive conclusions as they discussed evaporation rate and tis effect on climate and weather
Do students understand evaporation's place in the water cycle?	Attempted to explain but were unsuccessful	Successfully explained evaporation's place in the water cycle	Successfully explained evaporation's place in the water cycle, and demonstrated a thorough working knowledge of the entire water cycle

Understanding Chemical Changes - Changes of Properties

Outcomes:
• 301-11 describe changes that occur in the properties of materials when materials interact with each other

Note: Reversibility does not distinguish physical change from chemical change. When different chemicals are mixed in a solution new substances may be formed. However, the addition of more chemicals, application of heat, or stirring may cause the original chemicals to re-form (i.e., to reverse). In other cases, the chemical mixture causes a reaction in which the new substances are strongly bonded and the reaction cannot be reversed.

Lesson Activity Overview:
The curriculum for this section indicates that this lesson deals with knowledge outcomes so the priority should be put on understanding chemical reaction. However, inquiry based demonstrations will be used. For this, students should explore chemical changes of different materials. Many chemical reaction can be done with household chemicals (e.g., vinegar and baking soda yogurt and baking soda, an apple turing brown after it is peeled, milk and vinegar, Diet Coke and Mentos). The focus of this lesson should be on describing how materials change (change of properties) in a chemical reaction.

In order to describe the property changes in chemical reactions, students will have to engage in several explorations of chemical reactions. The best way do this is to set up several stations around the room and have students record their observations (focus on the property changes). Students should focus on the fact that new substances are formed.

Extension
1. Show a clip of a diet coke and mentos geyser (https://www.youtube.com/watch?v=yVQFLth4yIQ)

2. Have students create a diet coke and mentos geyser.
   The focus of either of these activities is to have students describe what they are observing in terms of the changes to the properties of each material.

   Assessment: Informal Formative
   Ensure that students have described the chemical changes and focus on the fact that new substances are formed.

Understanding Chemical Changes - Changes of Properties

At each station, record the materials involved in the grey title box. In that station's square, describe the chemical changes (change of the properties)

Station 1: _____	**Station 2: _____**

Station 3: _____	**Station 4: _____**

Understanding Chemical Changes - Reversibility

Outcomes:
301-10 identify and describe chemical changes to materials that are reversible and some that are not
207-3 work with team members to develop and carry out a plan
204-7 Plan steps to solve a practical problem and carry out a fair test of a science-related idea
204-5 identify and control major variables in investigations
(Carry out a plan to systematically distinguish a material based on its chemical properties)
206-2 compile and display data by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs (that represents the results of chemical tests used to distinguish one material from another).

Note: Reversibility does not distinguish physical change from chemical change. When different chemicals are mixed in a solution new substances may be formed. However, the addition of more chemicals, application of heat, or stirring may cause the original chemicals to re-form (i.e., to reverse). In other cases, the chemical mixture causes a reaction in which the new substances are strongly bonded and the reaction cannot be reversed.

Lesson Activity Overview:
The curriculum for this section indicates that this lesson deals with knowledge outcomes so the priority should be put on understanding chemical reaction. However, inquiry based demonstrations will be used. For this, students should explore chemical changes of different materials. Many chemical reaction can be done with household chemicals (e.g., vinegar and baking soda yogurt and baking soda, an apple turing brown after it is peeled, milk and vinegar, Diet Coke and Mentos). The focus of this lesson should be on distinguishing between chemical changes that are reversible and other that are not.

While it looks as though these chemical changes are not reversible, do not encourage this thought. Some chemical reactions reverse quite easily, while others virtually never reverse, instead, students should focus on the fact that new substances are formed.

1. Indicators are chemicals that easily undergo reversible chemical reactions, and in the process, change colours. Students could explore reactions by using blue litmus paper. This will turn pink when it reacts with chemicals such as vinegar, lemon juice, or other acids. It will reverse to blue when it reacts with chemicals such as baking soda, baking powder, or an anti-acid tablet dissolved in water, or other bases (alkalis). Students can make natural indicators out of these substances in hot water until it becomes colored; the more colour the better. The teacher may wan to prepare some of these using boiling water). Students could experiment to try to change these indicators from one colour to another using acids and bases.

2. Students should work with team members to develop and carry out a plan to distinguish one material from another based on chemical properties. Students should compile and display data that represents the results of the chemical tests by producing a table showing how household substances react when combined.

Students should be given as much range as needed to develop their own plan. However, if they require direction with how to proceed suggestions have been given.

a. Some substances such as baking powder, baking soda, flour and chalk will each react with vinegar.

b. Students should then be given unmarked samples of baking powder, salt, flour and baking soda. Students can identify the substances from their reactions during chemical changes

Assessment: Informal Formative
Ensure that students have completed their observations related to the reversibility of chemicals with Litmus paper.

Ensure that students are working as team members.

Ensure that students working with team members carry out the planned investigation as it was designed.

Assessment: Formal Formative
Ensure that students working as a team have planned an investigation thats purpose is to distinguish materials based on its chemical properties.

Ensure that students have compiled and displayed data that represents the results of chemical test used to distinguish one material from another.

Litmus Paper Tests

Record your observations based on each scenario

Blue Litmus Paper is dipped into Lemon Juice

Blue Litmus Paper is dipped into Lemon Juice, then dipped into a baking soda and water mix

Blue Litmus Paper is dipped into Vinegar

Blue Litmus Paper is dipped into Vinegar, then dipped into a baking soda and water mix

Properties and Changes in Materials
Strand - Sources/Masses of Materials in Objects

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<tr><td>205-3 Follow a given set of procedures</td></tr>
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Calculating the Mass of Objects

Outcomes:
104-5 Describe how the results of similar or repeated investigations may vary and suggest possible explanations for the variations
205-3 Follow a given set of procedures
300-11 Relate the mass of a whole object to the sum of the mass of its parts!

104-5, 205-3, 300-11 Follow a given set of procedures to relate the mass of a whole object to the sum of the mass of its parts, and suggest possible explanations for variations in the results

Lesson Activity Overview
The purpose of this lesson is to investigate the mass objects. To begin, its preferable that students investigate using a manual balance if possible. For further investigating students can be exposed to digital scales if available.

Students should have the opportunity to learn to use the scale.
Mass each of the objects listed and complete the table below.

Object	Estimated Mass (g)	Measured Mass (g)
4 pencils		
block of 10 lego pieces		
bag of marbles		
an apple		

The basic concept of this activity is to have student measure the mass of an object. To compare the mass of the whole object vs the sum of the mass of the parts.

Activity
Students will choose an object that can be broken into smaller parts. First, have students measure the mass of the object as a whole. Next, have students calculate the individual parts of the objects and then they will add the masses together. 205-3, 300-11

Journal
Students will realize that their sum and their mass of the whole do not add up to the exact amount. Students should describe how the variation in results. 104-6

Assessment:Informal Formative
Ensure that students follow the steps described to calculate the sum of the mass of individual parts of objets

Assessment:Formal Formative
Ensure that students have estimated and calculated the mass of objects in order to properly use a scale 300-11

Ensure that students have measured the mass of the object as a whole 300-11

Ensure that students have measured the mass of the individual parts of the object and calculated the sum of the entire object 300-11

Ensure that students have journaled about why there is discrepancies in data from the calculations of the sum of the mass of the object 104-6

Calculating the Mass of Objects

Describe the object as a whole:

Describe the individual parts of the of the object:

Mass of the whole object:_____g

Mass of the individual parts of the Object:

Part 1:_____g
Part 2:_____g
Part 3:_____g
Part 4:_____g
Part 5:_____g
Part 6:_____g
Part 7:_____g
Part 8:_____g
Part 9:_____g

Calculate the sum of the parts of the Object

Identifying the Sources of Materials of Objects

Outcomes:
107-8 Describe examples of manufactured materials that have been developed to improve human living conditions
205-8 Identify and use a variety of sources and technologies to gather pertinent information
300-12 Identify the source of materials found in an object and describe the changes to the natural materials required to make the object
205-8, 300-12 Identify the sources of the materials found in an object, and use a variety of methods and technologies to gather information to describe the changes required of the natural materials to create the object

Lesson Activity Overview
The concept of this lesson is for students to understand the different sources of materials that go into making a new material During the course of the unit students have investigated changing materials, whether chemical or physical. This lesson should focus on how changed material become a new product.

Students can explore a variety of different activities to accomplish these outcomes:

Why are materials important? What did you learn about materials, and their physical and chemical changes? (205-8, 300-12)

Indicate whether the objects listed below are natural or manufactured. If they are manufactured, identify the source of the materials in the object as either rock/mineral, petroleum, and/or wood/plant. (107-8, 205-8, 300-12)
– paper; glass, nylon tent, orange, car tires, bricks, cotton shirt, boulder, chair

Research a product to determine from which raw materials it is made, and how the raw materials are processed to make the final product. (205-8, 300-12)

Make a display of materials and the raw materials from which they are made.

Here is a sample of paper I made. I started with ... (Describe the materials used and the process involved in making the paper). (105-8, 300-12)

Assessment:Informal Formative
Ensure that students participate in activities related to identifying the different sources of materials in specific objects.

Assessment:Formal Formative
Depending on the task chosen, ensure that students appropriately completed the task as designed by the teacher.