Grade 7
SAMPLE
MATERIAL
INSIDE

Nelson

SCIENCE

About Nelson Science

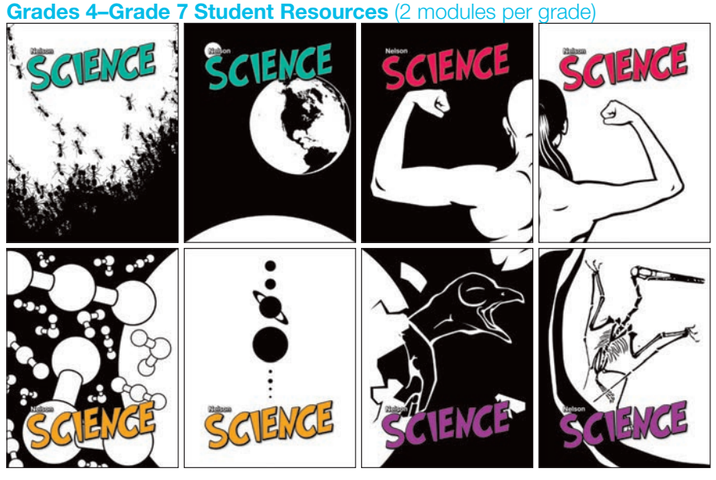
Developed by an experienced team of BC educators, *Nelson Science* is a comprehensive series built from the ground up to fully align with the new BC Science curriculum. Student resources feature activities designed to unleash students' innate curiosity. Infused with First Peoples knowledge and perspectives, and grounded in student-driven scientific inquiry, these resources open inquiry pathways that allow students to deepen their understanding of Big Ideas, develop Core and Curricular Competencies, and build place-based and content knowledge.

Key Features

- Focused on the doing of science—explorations and investigations are designed to develop the skills, processes, and habits of mind of scientific inquiry
- First Peoples scientific knowledge and perspectives are woven into activities through authentic contexts designed to support learning from First Peoples
- Design-focused activities allow students and teachers to cover all *Learning Standards* from the Applied Design, Skills, and Technologies (ADST) curriculum
- A suite of custom-developed, modifiable assessment tools, provide support for formative assessment of core and curricular competencies, as well as content knowledge

Kindergarten–Grade 3 Teacher's Resources

Grades 4–Grade 7 Student Resources (2 modules per grade)



Resource Component Overview

For Students

Kindergarten–Grade 3	Grades 4–7
Activity Cards ■ 9 double-sided, laminated Activity Cards featuring a unique activity on each side (total of 18 activities) to address all 4 strands: Biology, Chemistry, Physics, Earth/Space Science ■ 8 copies of each Activity Card (total of 72 cards) ■ Packaged in a durable cardboard box	**Student Resource** ■ Flexible modular format—2 print modules per grade ■ Each module contains 2 strands: – Biology and Chemistry – Physics and Earth/Space Science ■ Online access to the Science Skills Toolkit **Online Student Centre (sold separately)*** ■ Each Online Student Centre provides: – 1 eBook containing 2 strands (includes audio read-aloud for struggling readers) – Science Skills Toolkit to support curricular competencies

***Contact your Sales Representative for more information.**

For Teachers

Kindergarten–Grade 3	Grades 4–7
Teacher's Resource (includes Online Teaching Centre) ■ Print Teacher's Resource with facilitation strategies and assessment support **Teacher Cards** ■ 5 double-sided, laminated cards to support place-based activities **Online Teaching Centre** (included with Teacher's Resource) ■ Teacher's Resource eBook ■ Image bank containing art and photos from the Activity Cards in JPG format ■ Science Skills Toolkit with teaching notes to support curricular competencies ■ Modifiable Blackline Masters (includes assessment tools) ■ Interactive Whiteboard lessons for all 4 strands ■ Videos with teaching notes ■ Cross-curricular Connections with teaching notes ■ Literature Connections with teaching notes ■ Weblinks ■ RSS feeds	**Teacher's Resource** (includes Online Teaching Centre) ■ Flexible modular format—2 print Teacher's Resource modules per grade ■ Each module contains 2 strands: – Biology and Chemistry – Physics and Earth/Space Science **Online Teaching Centre** (included with Teacher's Resource) ■ Teacher's Resource eBook containing 2 strands ■ Image bank containing art and photos from the Student Resource in JPG format ■ Science Skills Toolkit with teaching notes to support curricular competencies ■ Modifiable Blackline Masters (includes assessment tools) ■ Animations with teaching notes ■ Videos with teaching notes ■ Literature Connections with teaching notes ■ Weblinks ■ RSS feeds

Nelson SCIENCE

Student Resource

Unit Opening Provocation

The opening image is visually engaging and is connected to the unit content or the curricular provocation.

Place-based activities provide opportunities to do science outside the classroom and are identified with a tree icon.

The unit opening activity is always a curricular provocation. The high-interest activity is intended to engage students and elicit their naturalistic questions about the conceptual content of the unit.

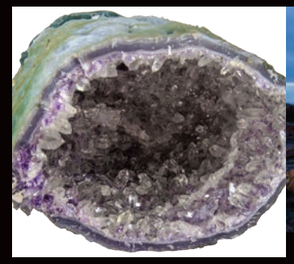
Student Resource

Explore!

Explore!, located after the unit opening provocation, provides a visual overview of the key topics in a unit. It replaces traditional tables of contents and supports more nonlinear, curiosity-driven approaches to the exploration of the science concepts in a unit.

EXPLORE!

Get ready! You are about to discover that elements consist of one type of atom and compounds consist of atoms of different elements chemically combined.



Student Resource

Exploration

Explorations present conceptual content. They often include one or more hands-on *Try This!* activities.

High-impact images directly relate to key concepts and provide some of the content of the lesson. These images offer opportunities for differentiated instruction and to show rather than tell students about the concepts.

Captions are informative and can include questions and/or activity suggestions that can serve as entry points into the science content and springboards for inquiry.

Questions throughout the narrative help students make connections, check their understanding, or extend their thinking.

CHEMICAL CHANGES IN NATURE

Changes to matter happen constantly in the natural world. Apples ripen, grass grows, and leaves decompose. Matter changes when it becomes part of the atmosphere, sits in a landfill, is washed away to the ocean, or is buried underground.

Because of chemical changes, matter that is part of a tree today can become part of a human body hundreds of years in the future. Chemical changes allow matter to be recycled and reused.

Rotting fruit is another example of chemical change.

After a salmon has spawned in the river and dies, bears and wolves carry the carcass into the surrounding forest. What is not eaten decomposes and releases nutrients that can be reused by other life. CE How are living things interconnected through chemical changes?

Forest fires, such as this one in the Chilcotin region of B.C., are one of the most spectacular chemical changes that happen in nature.

Student Resource

Exploration (continued)

Small narrative passages, often featuring local contexts, are written in student-friendly language and provide essential knowledge through engaging real-world contexts.

Many people, including First Peoples, observed chemical changes in their environment. Through observation and experience, they learned how they could use chemical changes in their lives.

Q: Why is it important for Earth that matter undergoes chemical changes? What benefits do chemical changes provide for ecosystems? What benefits do they provide for humans?

Before an animal skin can be used, it must be prepared or tanned. Many First Peoples of Canada, such as the Dakelh (Ka-kelh), Tsilhqot'in (Chil-co-teen), and Secwepemc (She-whep-m) in B.C., understand this process. Tanning hides involves physical changes when the hide is scraped and stretched. It also involves chemical changes when the hide is smoked and rubbed with a solution of animal brains and water. These women at the Teslin Tlingit (Kling-kit) Heritage Centre in Yukon work together to brain the hide after it has been scraped and stretched.

TRY THIS!

Find Chemical Changes in Nature

1. Go outside to look for evidence of chemical changes that have occurred or are occurring in your surroundings.
2. Record your examples of chemical changes and the evidence that tells you a chemical change has occurred.
3. Share your observations with your classmates. How are these changes important?

Try This! activities are structured activities that provide students with opportunities to develop science skills and conceptual understandings by doing science.

Nelson SCIENCE

Student Resource

Conduct an Inquiry!

Conduct an Inquiry! sections are full scientific inquiries. Students set their own specific question and decide how they will plan and conduct their investigation.

Conduct an Inquiry! uses the headings for scientific inquiry from the BC curriculum and prompts students through the inquiry stages.

The *Scientific Inquiry Toolkit*, available online, supports the development of the procedural knowledge of scientific inquiry.

Conduct an Inquiry!

How Can We Identify an Unknown Powder?

You are a forensic scientist called to investigate a crime.

A white powder is found on the kitchen floor of a crime scene. A similar powder is found on the shoes of a suspect in the crime.

Your task is to determine the identity of the unknown powder by comparing its properties to the properties of other known samples of white powders.

Question and Predict

Decide on a series of testable questions to investigate. For example, "Will the unknown powder react with vinegar?"

Plan and Conduct

Plan an investigation to solve the problem through fair testing of the powders. Decide on what materials and tools you will need. Make a plan for collecting and recording data. Carry out your procedures. Work safely.

Process and Analyze

Display your data in a way that clearly shows your results. What does your data tell you?

Evaluate

Were you able to identify the unknown powder? If not, what might be some other tests you could do to find out what it is?

Apply and Innovate

Use what you learned to design a different "whodunnit" challenge for your classmates, perhaps with a mystery liquid.

Communicate

Present your findings as an expert witness. Use scientific language to explain your procedures and your findings.

What new questions do you have as a result of your inquiry?

106 NEL

NEL 107

Nelson SCIENCE

Student Resource

Design and Make!

There is one *Design and Make!* activity in each unit that supports implementation of the ADST curriculum and allows students to develop their design thinking in relation to science topics. These open-ended design activities invite students to come up with their own design ideas and choose one to act on.

Design and Make!

WHO NEEDS TO KNOW ABOUT EARTH'S MATTER?

We know that the amount of matter on Earth is fixed. This has implications for how we should use matter. What can you design and make that will help people understand this issue?

Understand Context

Choose an audience other than your classmates. Decide what interview questions you could ask to find out what they already know and think about this issue. Conduct your interviews. Take notes.

Define

Think about what you found out. What does your audience know? What are they confused about? Do they understand the implications of a fixed amount of matter? Does it affect what they do? Do they care? Make a list of features you will have to address.

Ideate

Generate ideas of ways you could teach and influence your audience. Be creative. Add to others' ideas. Decide on criteria to screen your ideas. Choose an idea to work with.

Prototype

Talk to community experts, or do research to get information and inspiration. Develop your plan. Identify new skills, tools, or technologies you may need. Make a first version of your idea. Work safely.

Test

Test your prototype with a few members of your intended audience. Ask for feedback. Make changes and test again. Record your changes.

Make

Make the final version of your idea with the changes you decided on.

Share

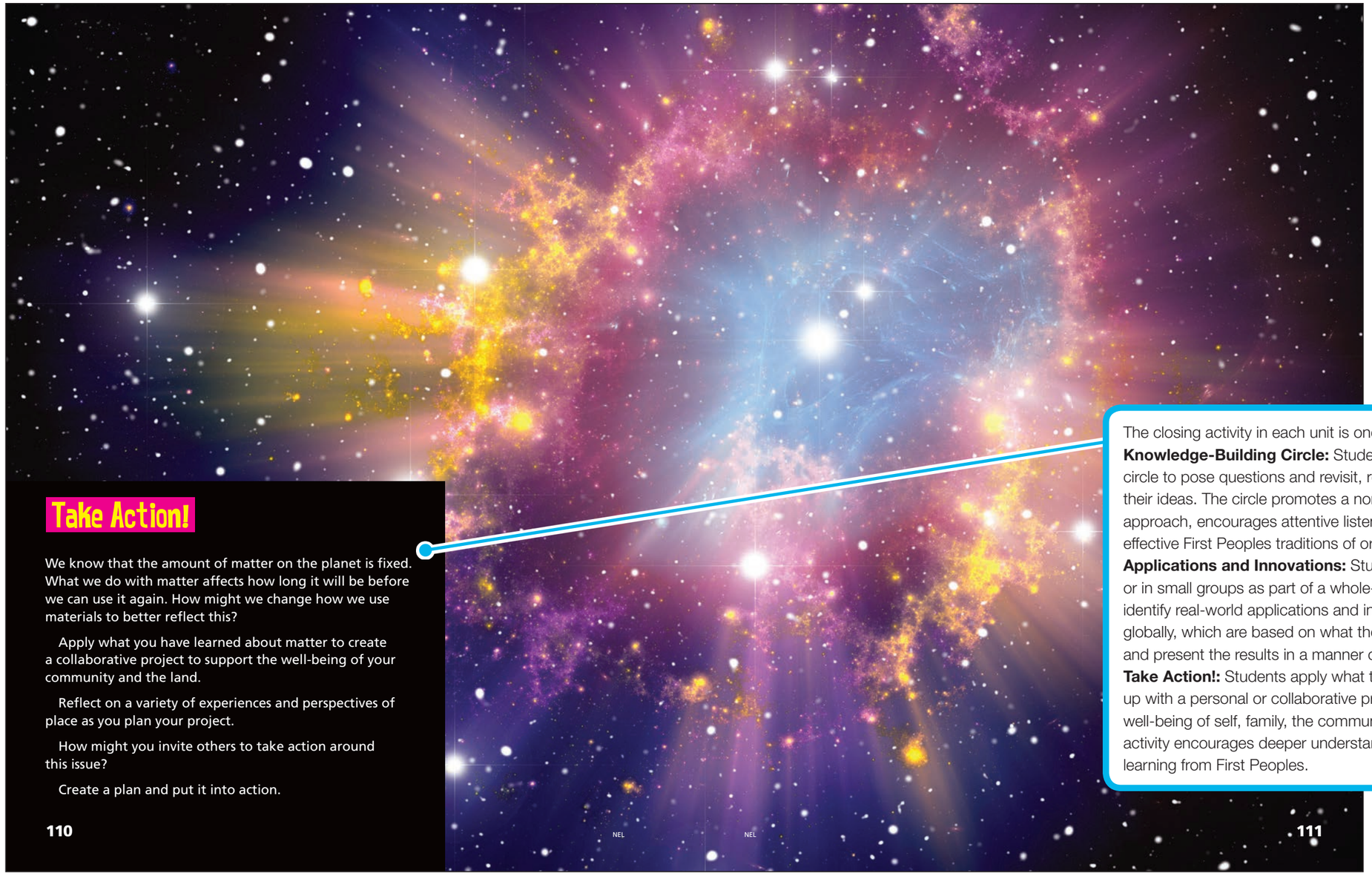
Share your final product with your chosen audience. Was it effective? How do you know? Reflect on your design process.

Design and Make! activities in the Student Resource use the headings for the design process from the BC Applied Design, Skills, and Technologies (ADST) curriculum and prompt students through the design stages.

The *Design Toolkit*, available online, provides additional support for the skills and processes of design.

Student Resource

Unit Closing Activity



Take Action!

We know that the amount of matter on the planet is fixed. What we do with matter affects how long it will be before we can use it again. How might we change how we use materials to better reflect this?

Apply what you have learned about matter to create a collaborative project to support the well-being of your community and the land.

Reflect on a variety of experiences and perspectives of place as you plan your project.

How might you invite others to take action around this issue?

Create a plan and put it into action.

110

111

The closing activity in each unit is one of three types:
Knowledge-Building Circle: Students come together in a circle to pose questions and revisit, refine, and consolidate their ideas. The circle promotes a non-hierarchical approach, encourages attentive listening, and models effective First Peoples traditions of oral sharing.
Applications and Innovations: Students work individually or in small groups as part of a whole-class jigsaw activity to identify real-world applications and innovations, locally and globally, which are based on what they learned in the unit, and present the results in a manner of their choosing.
Take Action!: Students apply what they learned to come up with a personal or collaborative project to support the well-being of self, family, the community, or the land. The activity encourages deeper understanding and promotes learning from First Peoples.

Teacher's Resource

Inquiring into...

This section provides teachers with a general overview of the unit. This section also notes any scientific descriptions and explanations that have recently been improved as new evidence became available.

Inquiring into Elements and Compounds

STUDENT RESOURCE PAGES 56–57

Online Teaching Centre Resources

Family Letter
Weblinks

In this unit, students inquire into elements and compounds. They become familiar with competencies related to scientific inquiry and develop an understanding of themselves as scientists in talking about, reflecting on, and receiving feedback about their inquiries. Students construct meaning about elements and compounds as substances and where they fit into the classification of matter. They learn that elements are made of one type of particle and compounds are made of two or more elements chemically combined. Students develop an understanding of chemical changes and the observable signs of a chemical change, and they explore the crystalline structure of solids as a property of pure substances. Students construct meaning through Explorations and inquiries designed to allow them to do science.

Developing the Big Idea and Unifying Concepts identifies and explains the big idea and the unifying concepts that are addressed in the unit.

Developing the Big Idea and Unifying Concepts

The Big Idea of Elements and Compounds is that **elements consist of one type of atom, and compounds consist of atoms of different elements chemically combined**. Students investigate and develop an understanding of elements and compounds by exploring their properties, including crystalline structure. They also explore how chemical changes are detected.

The unifying concepts for this unit are **matter and energy** and **change**. Students focus on the properties of matter (specifically, pure substances) but also touch on energy when they learn about chemical changes. As students explore chemical changes, they add to their understanding of change—a concept that has been introduced in previous grades in other contexts.

Multi-Year Classrooms highlights areas of potential combined instruction based on the content and big idea of the unit.

Multi-Year Classrooms

This unit builds on the Grade 5 Big Idea that solutions are homogeneous mixtures and the Grade 6 Big Idea that everyday materials are often mixtures. In Grade 7, students learn about types of matter that are not mixtures: pure substances. In Grade 8, they will build on their understanding of matter through the kinetic molecular theory and atomic theory.

Using This Provocation supports the opening activity in the Student Resource.

Using This Provocation

The illustration on Student Resource pages 56 and 57 shows an artist's rendition of an exploding star. In the opening Provocation activity, students explore the idea that elements were created in stars.

This Provocation encourages students to **demonstrate a sustained intellectual curiosity** about elements and compounds by introducing the topic with a thought-provoking quotation. A discussion of the quotation is a natural way for students to **identify questions to answer or problems to solve through scientific inquiry** throughout the unit. Sustained intellectual curiosity is one of the **habits of mind** associated with science.

Goals

Learning from First Peoples: The concept of interconnectedness is perhaps the single most important unifying concept in First Peoples knowledge and perspective on the natural world. The First Peoples worldview of the natural world is a holistic one. The natural world is a whole and everything is connected to everything else. All scientific evidence, including the evidence that led to Carl Sagan's statement, supports the long-standing First Peoples concept of interconnectedness of all things.

Learning from First Peoples links authentic First Peoples perspectives and scientific knowledge about the natural world to the skills and concepts in a given activity.

Science Background

All elements on Earth were made in or by stars. This understanding comes from a 1957 paper published in *Reviews of Modern Physics* and provides us with a description of the origin of the elements. Before this explanation, it was believed that all elements were products of the Big Bang about 14 billion years ago. But this theory accounted only for the light elements such as hydrogen and helium. So where did the heavy elements found in nature come from? The paper argued that all heavy elements were created within stars through nuclear fusion, known as stellar nucleosynthesis. As stars cool and "die," they release the heavy elements into space. Eventually, some of this material is incorporated into planets and even into our bodies.

Since all elements heavier than helium have been nucleosynthesized by stars, all the heavier chemical elements that are the raw materials of life were at one time part of a stellar life cycle. We are a product of the stars. This is one of the most profound insights to have arisen out of twentieth-century astronomy.

Observing and Supporting Learning

- If this is the first unit of the year, consider distributing **Family Letter**.
- Allow students time to discuss the Carl Sagan quotation and the opening Provocation image on Student Resource pages 56 and 57.
- Invite students to watch online video clips about how the elements that make up our bodies and all matter were made in stars and distributed through space through supernovae (see Weblinks).

Blackline Master

Teacher's Resource

Exploration

Curricular and Core Competencies identifies the curricular competencies (scientific skills and processes and habits of mind) that students will be using to build their science knowledge and any core competencies that they will have significant opportunities to develop.

The *Focus Question* identifies a key question that is derived from the learning standards for content knowledge.

Chemical Changes in Nature

STUDENT RESOURCE PAGES 100–103

You Will Need

per student:
- clipboard (optional)

Online Teaching Centre Resources

Try This! Find Chemical Changes in Nature
Place-Based Learning Reflection
Two-Column Chart
Documenting Learning: Chemical Changes in Nature
Self-Assessment Social Responsibility: Facets
Self Assessment Social Responsibility: Prompts
Science Inquiry Toolkit (question and predict, plan and conduct)

Using This Exploration

Curricular and Core Competencies: This Exploration invites students to think about chemical changes in nature. It engages students in a place-based outdoor activity in which they are asked to **ensure that ethical guidelines are followed in their investigation** as they **experience and interpret the local environment** to **observe and record chemical changes**. Students are asked to **communicate their findings and ideas using scientific language** and to **express and reflect on experiences and perspectives of place**.

Students will be developing the core competency of **Social Responsibility** (**facet: contributing to community and caring for the environment**) as they ensure ethical guidelines are followed in their field investigation.

Focus Question: In what ways are chemical changes important in nature?

Big Idea and Unifying Concepts: This Exploration extends student thinking about chemical changes and supports students' understanding of the unifying concepts of **matter and energy** and **change**. As students look for evidence of chemical changes in nature, they continue building on their understanding of the Big Idea that **compounds consist of atoms of different elements chemically combined**.

Learning from First Peoples: Understanding interconnectedness involves considering our relationships to ourselves and to everything around us, such as other people, living things, and the environment. Given the awareness that we are all related, it is important to think about how one's actions may affect others (such as family, community, and/or the land).

Science Background

The vast majority of matter in our universe was created several billion years ago. Consequently, the atoms around us have also existed for billions of years and are continually being recycled by chemical changes. Nitrogen, for example, is the key element in biologically important compounds such as proteins and DNA. The air that we breathe contains 78% nitrogen. Unfortunately, our bodies have no way of converting the nitrogen molecules in air into a usable form. Hence, we rely on protein-rich foods such as meat and beans for our sources of nitrogen. But how does nitrogen get into beans? The root systems of many legumes, including beans, contain nodules that host colonies of bacteria. These bacteria convert atmospheric nitrogen into simple nitrogen-containing substances that the host bean plant absorbs and uses to manufacture protein.

(continued)

In order to be recycled, the nitrogen trapped in the tissues and waste of plants and animals must be released back to the environment. As plant and animal matter decomposes, other bacteria break down nitrogen-containing compounds and ultimately release the nitrogen molecules to the atmosphere.

Learning from the Land

The Try This! activity is a placed-based activity that uses the land to teach students about chemical changes. The activity adds to their existing knowledge and sense of place.

Learning from the Land provides teaching strategies and prompts when place-based learning opportunities arise.

Observing and Supporting Learning

- Ask students to read Student Resource pages 100 to 103 and discuss the examples and questions.
- Consider using **Documenting Learning: Chemical Changes in Nature** to document your observations of student learning as students respond to the images and text and do the hands-on activity in this Exploration.

Assessment Tool

SAMPLE RESPONSES

Q: How are living things interconnected through chemical changes?

R: When living things die, the nutrients in their bodies provide food for other living things, such as microbes, insects, mammals, birds, and even trees. Trees receive the nitrogen that is released through decomposition.

Q: Why is it important for Earth that matter undergoes chemical changes?

R: Since the matter on Earth is essentially fixed and we cannot make new matter, existing matter must get broken down so it can be recycled and reused again in different forms. Chemical changes are the only way for matter to break down and be reused.

Q: What benefits do chemical changes provide for ecosystems?

R: Chemical changes allow for the nutrient cycle to occur, which ensures that an ecosystem can survive and all the organisms in it have nutrients available for their survival.

Q: What benefits do they provide for humans?

R: For humans to grow, repair any damage, and survive, we need matter. Most of the matter that we have access to is not in a form that our bodies can use, so it has to get broken down. This happens when our bodies digest food.

Teacher's Resource

Exploration

Colour-coded icons, shown at point-of-use, act as identifiers for coverage of curricular goals, and core and curricular competencies.

Goals

Goals

Social Responsibility

Blackline Master

- Before going outside, ask students to determine ethical guidelines for doing an outdoor activity and to minimize their impact on the natural environment and on other living things. Students may come up with a list such as the following:
  - Stay on designated trails.
  - Do not harm living things such as insects, plants, or trees.
  - Do not litter.
- Having students consider respect for nature in this activity supports the **habits of mind** associated with science as well as their development as **scientifically literate citizens**.
- Once outside, prompt students to **acknowledge the traditional territory of the local First Peoples** on whose land they will be learning, then take a moment to mindfully connect to the land.
- Some students may wish to document this activity as an example of their **Social Responsibility** competency in Science, and complete a self-assessment using **Self-Assessment: Social Responsibility Facets** (or **Prompts**).

Try This! provides facilitation strategies for these hands-on activities in the Student Resource, including notes about materials, safety precautions, and sample responses.

TRY THIS! Find Chemical Changes in Nature

Purpose

Students find examples of chemical changes in their local natural environment.

A Note about Safety

Familiarize yourself with any poisonous plants or animals in your local area, and remind students to be cautious about touching plants and to avoid touching animals. Be aware of student allergies and be prepared to deal with them. Remind students not to taste anything as they make observations. In rainy or cold weather, ensure that students are properly dressed, and remind them to watch their step to avoid slipping.

Notes

- Consider the season and what chemical changes might be seen along the route.
- Provide clipboards, if available, to assist students as they record their observations. Students may also want to record their observations with photographs or video. Remind students to also record any questions they have.
- You may wish to hand out **Try This! Find Chemical Changes in Nature** to provide students with a copy of the activity to use outdoors.
- You may also wish to hand out **Two-Column Chart** for students to use to record the examples of chemical changes and the evidence of chemical changes they observed.

Sample Responses

3. Examples of chemical changes I observed were: plants growing, car exhaust, rust on a car, decomposition of leaves on the ground, animals that have chemical reactions going on inside their bodies, photosynthesis in plants, people breathing. Evidence of chemical changes I observed were leaves changing colour and producing a smell as they decomposed, metal changing colour and forming a new substance as it rusted, and heat produced by animals' bodies.
4. The plants growing and decomposing leaves and people breathing are important changes for the cycle of life. Car exhaust is produced by burning gas, which is an important chemical change that powers the cars we use for transportation.

- Some of the "observations" students make will actually be inferences that they are able to make based on their prior knowledge and their ability to interpret the local environment.
- While students are still outside (or if the weather is inclement, as soon as they return to the classroom), have them reflect on their experience and perspectives on the place they observed. You may wish to hand out **Place-Based Learning Reflection** for this purpose.

Blackline Master

Formative Assessment supports teachers with assessment strategies for observing students, adjusting instruction, and providing descriptive feedback.

Formative Assessment

Collecting Information	Using Information
As students work outdoors, observe the extent to which they follow ethical guidelines for a field study in the natural environment.	Provide students with descriptive feedback on the extent to which they are considering ethical guidelines as they work in nature. For example, *I see you examined those rotting leaves without disturbing them too much. I see you are trying to be quiet so as not to frighten animals.*
Observe whether students are correctly identifying chemical changes.	If students are having difficulty correctly identifying chemical changes in nature, adjust instruction by giving them a list of the evidence of chemical changes (i.e., a change in colour; bubbles of gas; a change in smell; the release or absorption of heat, light, or sound; the formation of a new solid) and have them find examples where they can see those things or infer that they are occurring.
Observe the extent to which students are experiencing and interpreting the local environment in order to identify chemical changes.	Provide students with descriptive feedback about how they are experiencing and interpreting the local environment to identify chemical changes. For example, *You have identified photosynthesis as a chemical change because you know it is occurring in these plants. You know that the fungus on this tree is a decomposer and that decomposition is a chemical change.*
As students communicate their findings and ideas, listen for the extent to which they use scientific language to distinguish between observations and inferences.	If students have difficulty distinguishing between observations and inferences, provide additional instruction using the suggestions in the Tips to Teachers in the **Scientific Inquiry Toolkit**.
Observe the extent to which students are able to express and reflect on their experiences and perspectives of **place**.	If students have difficulty getting started, adjust instruction by having them answer the questions from the Reflect on place section of the **Scientific Inquiry Toolkit**.

Goals

Teacher's Resource

Conduct an Inquiry!

You Will Need is a list of materials teachers will need for any activities in the Exploration.

Conduct an Inquiry!
How Can We Identify an Unknown Powder?

You Will Need

per group:
- magnifying lens
- white powders such as baking soda, cornstarch, baking powder, salt, sugar, cream of tartar
- eyedroppers
- small cups
- spoons
- dilute iodine solution, vinegar, water, red cabbage juice

Online Teaching Centre Resources

Scientific Inquiry Process
Documenting Learning: How Can We Identify an Unknown Powder?
Scientific Inquiry Scale
Documenting Learning: Communication: Profiles
Documenting Learning: Communication: Facets
Documenting Learning: Creative Thinking: Profiles
Documenting Learning: Creative Thinking: Facets
Documenting Learning: Critical Thinking: Profiles
Documenting Learning: Critical Thinking: Facets
Science Inquiry Toolkit (identify testable question; plan procedures; identify and control variables; identify materials, tool, and equipment; plan data collection; conduct procedures; use tools, materials, and equipment safely; observe; measure; record; compile and display data; draw conclusions; evaluate procedures; identify possible sources of error; identify applications; collaborate; communicate findings and ideas; use scientific language)

A Note about Safety

Remind students not to taste any of the samples or solutions.

Assessment Tool

Using This Inquiry

Curricular and Core Competencies: In this Inquiry, students are forensic scientists who must determine the identity of the unknown powder by comparing its properties to the properties of other known samples of white powders. Students **identify a series of testable questions, collaboratively plan an investigation to solve the problem, measure and control variables (dependent and independent) through fair tests, observe, measure and record data,** and **ensure that safety guidelines are followed in their investigation**. They **construct and use a method to represent their data** and **use scientific understandings to draw a conclusion**. They **reflect on their investigation methods and the quality of the data collected**. They role-play an expert witness to **communicate their findings using scientific language**. They are invited to **transfer and apply their learning** to **cooperatively design** a "whodunnit" challenge for their classmates.

Focus Question: How can we use chemical changes to help us identify a substance?

Big Idea and Unifying Concepts: This inquiry provides a fun way for students to consolidate their learning about the unit's Big Idea, that **elements consist of one type of atom, and compounds consist of atoms of different elements chemically combined**, and the unifying concepts of **matter and energy** and **change**.

Observing and Supporting Learning

- Students should realize that they will be able to identify the mystery powder only once they know its physical and chemical properties, and their investigation needs to test each powder to determine its properties and compare it against the crime scene sample.
- Suggested powders include baking soda, baking powder, cornstarch, cream of tartar, salt, and sugar.
- Suggested testing liquids are dilute iodine, vinegar, water, and red cabbage juice.
- Iodine solution is readily available as a disinfectant at drug stores in a 10% solution. It can be further diluted several times and still work well.
- To prepare red cabbage juice, roughly chop a red cabbage and place in a pot. Add water until the cabbage is just covered. Bring to a boil and simmer for 10 minutes. Strain the red cabbage juice and cool.
- Consider using **Documenting Learning: How Can We Identify an Unknown Powder?** to document your observations of students' scientific inquiry skills and processes as they do this investigation.

STUDENT RESOURCE PAGES 106–107

Blackline Master
Assessment Tool
Assessment Tool
Communication
Creative Thinking
Critical Thinking

Custom-developed, modifiable assessment tools support formative assessment of core and curricular competencies, as well as content knowledge.

- Consider handing out **Scientific Inquiry Process** and reviewing the inquiry process as a class.
- Observe students as they work and highlight relevant sections of the **Scientific Inquiry Scale**.
- You may wish to observe with a focus on the core competency of **Communication**, **Creative Thinking**, or **Critical Thinking**.
- Prepare the sample materials and label them. Choose one to be the mystery powder. A good option to choose as the mystery powder is baking soda. The table below summarizes how each powder will react with each testing liquid.

	baking powder	baking soda	cornstarch	cream of tartar	sugar	salt
reaction with water	none	none	none (but creates the non-Newtonian liquid, Goo)	none	none (but will feel sticky after it dries)	none
reaction with vinegar	produces bubbles of gas	produces bubbles of gas	none	none	none	none
reaction with iodine	turns black	none	turns black	none	none	none
reaction with red cabbage juice	turns blue	turns blue	none	none	none	none

- In Question and Predict, students' testable questions could include testing the mystery powder with different liquids. For example, *Will the unknown powder react with water? Will the unknown powder react with iodine?*
- In Plan and Conduct, students plan a procedure to test the mystery powder and the known powders. Students will likely plan a range of tests to test each powder with each liquid.
- In Process and Analyze, students may choose to display their data in a table or a flow chart. You may wish to hand out **Flow Chart**.
- For Evaluate, ask students to self-assess their inquiry procedures. Allow students to implement their improvements and conduct their test again.
- In Apply and Innovate, students may suggest applications such as testing for allergens, sorting ingredients in a pantry, or testing for the presence of particular substances in the local natural environment.
- For Communicate, students can present their findings as an expert witness in a variety of ways, such as a skit, video, or written report.

Blackline Master

Formative Assessment

Collecting Information	Using Information
Observe students as they use the scientific inquiry skills and processes.	If students are having difficulty with any of the skills used in this inquiry, provide additional instruction based on the Tips for Teachers in the **Scientific Inquiry Toolkit**.

Nelson SCIENCE

Teacher's Resource

Design and Make!

Design and Make! Who Needs to Know About Earth's Matter?

STUDENT RESOURCE PAGES 108–109

Online Teaching Centre Resources

- Design Process
- Design and Make! Share Stage
- Scientific Inquiry Scale
- Design Scale
- Design Self-Assessment Scale
- Self-Assessment: Communication: Profiles
- Self-Assessment: Communication: Facets
- Self-Assessment: Creative Thinking: Profiles
- Self-Assessment: Creative Thinking: Facets
- Self-Assessment: Critical Thinking: Profiles
- Self-Assessment: Critical Thinking: Facets
- Self-Assessment: Social Responsibility: Profiles
- Self-Assessment: Social Responsibility: Facets
- Design Toolkit

Big Ideas and Unifying Concepts identifies how the doing and knowing of science can roll up toward the big idea and goals of the science curriculum.

Science Background provides a detailed overview of the science concepts covered in a given activity and, where applicable, addresses possible misconceptions.

Using This Design and Make!

Curricular and Core Competencies: This activity uses the curricular competencies of all stages of the design process—Understanding Context, Defining, Ideating, Prototyping, Testing, Making, and Sharing—as well as the four curricular competencies under the Apply and Innovate section of the Science curriculum. As students design and make a plan for how to teach and influence an audience, they will be developing the core competencies of **Creative Thinking (all facets), Critical Thinking (facet: design and develop), Communication (all facets)** and **Social Responsibility (facet: contributing to community and caring for the environment)**.

Big Idea and Unifying Concepts: As students consider how to increase people's understanding of the implications of the fixed amount of matter on Earth, they further develop unifying concept of **matter and energy**. Designing and developing a product addresses the three Big Ideas of the ADST curriculum: **Design can be responsive to identified needs, Complex tasks require the acquisition of additional skills**, and **Complex tasks may require multiple tools and technologies**.

Science Background

Earth is a closed system in that no matter enters or leaves Earth, with the exception of small amounts of matter from meteorites that land on Earth or objects that are launched into space. Matter on Earth is finite, and even though atoms may constantly be cycled around Earth to form new substances, no new atoms are created or destroyed. This may seem like great news as it may seem that we have enough matter on Earth and that we can keep reusing what we have, but how we use matter has implications for how we can use it later.

The best way to ensure our long-term use of our finite matter is through conservation and careful management. We can make choices to help conserve resources, such as drinking tap water instead of bottled water, choosing organic farming methods that reduce water pollution, or using reusable grocery bags instead of single-use plastic bags. We can also invest in technologies such as renewable wind and solar energy sources that reduce our use of fossil fuels. By choosing how and when we use matter now, we affect how and when we can use matter later.

Observing and Supporting Learning

Assessment Tool

- Observe students as they work and highlight relevant sections of the **Design Scale** and in the Apply and Innovate section of the **Scientific Inquiry Scale**.

Blackline Master

- Consider distributing **Design Process** and reviewing it with students.
- In Understanding Context, students may select peers, younger students, parents or other adults, or the community at large as their audience. Students should keep their audience in mind as they develop their interview questions.
- In Define, students analyze their interview notes to determine the key features their product needs to address. Will their product need to be mostly educational, mostly persuasive, or both? Remind students to consider practical restraints as well, such as time and skills needed to create the product.
- For Ideate, students may decide on a variety of formats, such as a brochure, a poster, a blog, a video, or a skit. Encourage students to think creatively about both format and content.
- In Prototype, students identify additional sources of information and inspiration. (The latter is often as important as the former.) These might be online or community resources. When they feel they have enough information, students develop a plan that identifies key stages and resources, and construct a first version of their product.
- For Test, students may need assistance when arranging to meet with a few members of their intended audience. Remind students to ask for honest feedback and thank participants for their feedback and encouragement.
- In Share, students will share their final product with their chosen audience and attempt to evaluate its effectiveness. Ask students to describe their design process to classmates using the question prompts on **Design and Make! Share Stage**. Some students may be able to use the prompts independently to frame their oral presentation. Other students may benefit from you asking them as interview questions.

Blackline Master

Formative Assessment

Collecting Information	Using Information
Observe students as they work through the applied design steps.	If students are having difficulty with any of the steps in the design process, provide additional instruction based on the Tips for Teachers in the **Design Toolkit**.

- Ask students to consider whether they want to use this design activity as an example of their **Creative Thinking, Critical Thinking, Communication**, or **Social Responsibility** competencies and complete a self-assessment. Students may make different choices depending on what they see as their strengths in the activity.

Creative Thinking
Critical Thinking
Communication
Social Responsibility

- Ask students to highlight applicable "I can" statements on the **Design Self-Assessment Scale**, and in the Apply and Innovate section of the **Scientific Inquiry Self-Assessment Scale**. If some students have difficulty self-assessing accurately, conference with them individually. Share your assessment of their work in the form of descriptive feedback, then provide an opportunity to revise their self-assessment if they wish.

Blackline Master

Teacher's Resource

Unit Closing Activity

Online Teaching Centre Resources is a list of resources in the Online Teaching Centre that can be used to support the Exploration, such as Blackline Masters, Assessment Tools, and the Science Skills Toolkit.

Observing and Supporting Learning suggests possible teaching strategies for engaging students in this activity.

Take Action!

STUDENT RESOURCE PAGES 110–111

Online Teaching Centre Resources

- Scientific Inquiry Scale
- Scientific Inquiry Self-Assessment Scale
- Documenting Learning: Communication: Profiles
- Documenting Learning: Communication: Facets
- Self-Assessment: Communication: Facets
- Self-Assessment: Communication: Prompts
- Documenting Learning: Creative Thinking: Profiles
- Documenting Learning: Creative Thinking: Facets
- Self-Assessment: Critical Thinking: Facets
- Self-Assessment: Critical Thinking: Prompts
- Documenting Learning: Critical Thinking: Profiles
- Documenting Learning: Critical Thinking: Facets)
- Self-Assessment: Creative Thinking: Facets
- Self-Assessment: Creative Thinking: Prompts
- Documenting Learning: Social Responsibility: Profiles
- Documenting Learning: Social Responsibility: Facets
- Self-Assessment: Social Responsibility: Facets
- Self-Assessment: Social Responsibility: Prompts
- Science Inquiry Toolkit (act on new ideas and questions, collaborate, reflect on place)

Using This Closing Activity

Curricular and Core Competencies: In this closing activity, students **transfer and apply their learning** that there is a fixed amount of matter on Earth to **cooperatively design a project that contributes to the care of themselves, others, the community, and the world through personal and collaborative approaches** that may involve others as well as themselves.

As students develop and implement their plan, they will be developing the core competencies of **Communication (facets: connect and engage with others to share and develop ideas** and **collaborate to plan, carry out), Creative Thinking (all facets), Critical Thinking (facet: design and develop)**, and **Social Responsibility (facet: contributing to community and caring for the environment)**.

Focus Question: How can we take action in our community to improve how the Earth's fixed amount of matter is used?

Big Idea and Unifying Concepts: In this activity, students apply what they have learned about the unifying concept of **matter and energy**. In taking action in their community, in being the change, they extend and personalize their understanding of the unifying concept of **change**.

Learning from First Peoples: Students will use consider our use of materials in the context of interconnectedness as they identify the consequences to our community and environment. As students implement their plan, they support the well-being of the local and greater communities, as well as the environment. This is an example of wisdom-in-action.

Learning from the Land

Students will develop a plan to undertake a concrete action to use Earth's resources wisely. Their plan will support the well-being of the land, which in turn sustains the community that depends on it.

Observing and Supporting Learning

- Some possibilities for projects students could undertake include
  - launching a program to increase reusing or recycling in the school or community
  - personally and collectively reducing their use of certain forms of matter such as plastics or water, and creating a blog that encourages others to join them
  - starting a walking school bus to reduce the use of fossil fuels but stay safe
  - creating a school vegetable garden, making sure the food gets eaten, and composting any plant waste back into the garden

Formative Assessment

Collecting Information	Using Information
Observe whether students are able to come up with ideas for a project to address the issue of a fixed amount of matter on Earth.	If students have trouble generating ideas, adjust instruction by having a whole-class discussion to generate ideas, then let small groups or individuals choose from among those ideas or come up with other ideas that those have sparked.
Observe for evidence that students are transferring and applying their learning to this new project.	Provide descriptive feedback that identifies what learning students are transferring and applying; for example, *I can see you are applying what you learned when you designed and made your project to convince people this issues was important.*

- Observe students as they work, and highlight relevant sections of the **Scientific Inquiry Scale**.
- Ask students to highlight applicable "I can" statements on the **Scientific Inquiry Self-Assessment Scale**. If some students have difficulty self-assessing accurately, conference with them individually.
- Ask students to consider whether they want to use this closing activity as an example of their **Communication, Creative Thinking, Critical Thinking,** or **Social Responsibility** competencies and complete a self-assessment. Students may make different choices depending on what they see as their strengths in the activity.
- If you plan to observe with a core competency focus, consider using **Documenting Learning: Communication: Profiles** (or **Facets**), **Documenting Learning: Creative Thinking: Profiles** (or **Facets**), **Documenting Learning: Critical Thinking: Profiles** (or **Facets**), or **Documenting Learning: Social Responsibility: Profiles** (or **Facets**).

Assessment Tool

Blackline Master

Communication

Creative Thinking

Critical Thinking

Social Responsibility

Blackline Master

Assessment Tool

Notes

Notes

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