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Manitoba

hands-on science

An Inquiry Approach With Big Ideas and Global Competencies

Grade 1

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Hands-On Science for Manitoba
Hands-On Science for Manitoba, Grade 1
An Inquiry Approach With Big Ideas and Global Competencies

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Introduction to *Hands-On Science* for Manitoba, Grade 1

Introduction to *Hands-On Science*

About *Hands-On Science*

Hands-On Science helps develop students' understanding of science concepts, while promoting scientific literacy through active inquiry, problem solving, and decision making. Each activity in ***Hands-On Science*** encourages students to explore, investigate, and ask questions as a means of heightening their curiosity about the world around them. Students solve problems through first-hand experiences and by observing and examining objects within their environment. For young students to develop scientific literacy, concrete experience is of the utmost importance—in fact, it is essential.

The Dimensions of the Manitoba Science Curriculum

Categories of Learning Outcomes

Science plays a fundamental role in the lives of all Canadians. The Manitoba science curriculum (2025) identifies five strands of learning outcomes:

A. **Indigenous Knowledge Systems**—First Nations, Métis, and Inuit have always engaged in scientific ways of knowing, doing, and being; all learners of science benefit from developing an understanding of how different Indigenous communities interpret the natural world, apply scientific principles, and create technologies in interrelated and sustainable ways.

B. **Science Identity**—Throughout history, peoples from diverse backgrounds have played roles in the development of science, and all people, societies, and environments are affected by science and technology; all learners must be empowered to see themselves as participants in the collective scientific endeavour.

C. **Practical Science**—STSE (science, technology, society, and environment) contexts, scientific measurement, scientific actions and practices, scientific instruments, and awareness of the application of science in careers, hobbies, and activities; all learners must be equipped with scientific skills and attitudes to take action for the betterment of society and a sustainable future.

D. **Nature of Science**—The purpose, methods, applications, and implications of scientific inquiry; all learners must develop the scientific confidence to navigate the complexities of an information-rich environment, including differentiating between legitimate scientific information, pseudoscience, misinformation, and disinformation.

E. **Scientific Knowledge**—Information, concepts, principles, theories, and facts that have been acquired, tested, and validated through the systematic process of scientific inquiry; all learners must acquire a fundamental core knowledge base to become scientifically literate citizens.

These learning outcomes are integrated into the Big Ideas to form the foundation of ***Hands-On Science***.

Hands-On Science Big Ideas and Learning Outcomes

The Manitoba science curriculum is organized around 14 Big Ideas: ten Big Ideas *in* science, and four Big Ideas *about* science. The ten Big Ideas *in* science are addressed through the scientific knowledge learning outcomes for each grade. These ten Big Ideas *in* science are:

1. Matter
2. Fields
3. Force
4. Energy
5. Earth Science
6. Space Science

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7. Life Science
8. Life Systems
9. Genetics
10. Evolution

Each grade addresses several of these Big Ideas. The five Big Ideas *in* science addressed in grade 1 are:

1. **Matter:** All matter in the universe is made of very small particles.
4. **Energy:** The total amount of energy in the universe is always the same but can be transferred from one energy store to another during an event.
6. **Space Science:** Our solar system is a very small part of one of billions of galaxies in the universe.
8. **Life Systems:** Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.
10. **Evolution:** The diversity of organisms, living and extinct, is the result of evolution.

Learning outcomes are identified for each Big Idea in science. These learning outcomes describe the expected knowledge and skills students should have by the end of grade 1. The learning outcomes for each Big Idea are presented in the Grade 1 Learning Outcomes chart on pages 11–12. Detailed information about the Big Ideas is provided at the beginning of each unit.

There are four Big Ideas *about* science addressed through the Nature of Science strand:

11. Purpose
12. Method
13. Application
14. Implication

Of these four, the two Big Ideas focused on in grade 1 are:

12. **Method:** Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.
13. **Application:** The knowledge produced by science is used in engineering and technologies to create products and processes.

NOTE: The publication *Working With Big Ideas of Science Education* <https://www.interacademies.org/publication/working-big-ideas-science-education> is an excellent resource for further information on Big Ideas *in* and *about* science.

Guiding Questions

The grade 1 science curriculum focuses on three guiding questions that are part of the foundation of ***Hands-On Science for Manitoba, Grade 1***.

These guiding questions anchor the grade 1 learning outcomes, which can be viewed as a menu from which to create lesson plans and unit plans rather than as a list that needs to be followed in a specific order. As teachers develop their course of study, they should keep these guiding questions in mind. The three guiding questions for grade 1 are:

- What is matter and how is it used?
- What is energy?
- What are seasonal changes and how do they affect various living things?

Global Competencies in Science

The Manitoba science curriculum identifies six global competencies that students will use and develop throughout the learning process. These are:

- **Critical Thinking**—solving problems, testing ideas, and posing questions
- **Creativity**—being curious about concepts and using personal ideas in inventive and unique ways

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- **Citizenship**—understanding that the natural world is essential to our survival, and it needs to be protected by all people in society, children and adults alike
- **Connection to Self**—developing a positive attitude toward science and building confidence to ask questions, take risks, and grow as a learner
- **Collaboration**—working effectively with others, including listening to and respecting the perspectives of others
- **Communication**—all forms of interaction with others. During science activities, students communicate orally, in writing, and through a variety of skills, such as graphing, interpreting data, drawing diagrams, and constructing models.

Enduring Understandings

Hands-On Science for Manitoba, Grade 1 provides students with many opportunities to explore the five Big Ideas and their related learning outcomes using the global competencies. In doing so, students build enduring understandings of science. The Manitoba science curriculum describes five enduring understandings as follows:

- **Science is about explaining phenomena**. Science explains the cause or causes of phenomena observed in the natural world using various scientific practices.
- **Science is a collective endeavour**. Science is a collective human endeavour that discovers laws, builds models, and formulates theories that best fit the empirical evidence available at a particular time.
- **Science is interconnected with technology**. Science involves a symbiotic relationship between scientific understandings and technological developments for the solution of problems.
- **Science has complex implications**. Science and its applications have ethical, social, personal, economic, political, cultural, and environmental implications, such as considerations of sustainability, ethics, and social justice.
- **Science empowers human agency**. Science fosters curiosity and the development of a science identity that supports lifelong interest and informs decision making and agency in everyday life.

Hands-On Science Principles

Hands-On Science is grounded in a research-based approach that puts students at the centre of the teaching and learning process. The following principles reflect this approach:

- Effective science education involves hands-on inquiry, problem solving, and decision making.
- The development of students' understanding of science concepts and skills forms the foundation of science education.
- Children have a natural curiosity about science and the world around them. This curiosity must be maintained, fostered, and enhanced through active learning.
- Science activities must be meaningful and worthwhile and relate to real-life experiences.
- The teacher's role in science education is to facilitate activities and encourage critical thinking and reflection. Children learn best by doing, rather than just listening; therefore, instead of simply telling, the teacher should focus on formulating and asking questions, setting the conditions for students to ask their own questions, and helping students make sense of the events and phenomena they have experienced.
- Science should be taught in conjunction with other subjects. Themes and topics should

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integrate ideas and skills from several core areas whenever possible.

- Science education should encompass, and draw on, a wide range of educational resources, including literature, nonfiction research material, audio-visual resources, and technology, as well as people and places in the local community.
- Science education should be infused with Indigenous ways of knowing, being, and doing, as well as diverse multicultural perspectives.
- Assessment of student learning in science should be designed to focus on performance and understanding and should be conducted through meaningful assessment techniques used throughout each unit. See the detailed overview of the ***Hands-On Science* Assessment Plan** on pages 26–29.
- Science education is inclusive in nature. Learning opportunities should meet the diverse needs of all students through differentiated instruction and individualized learning experiences.

The Inquiry Approach to Science

As students explore science concepts, they are encouraged to ask questions to guide their own learning. This inquiry approach is based on five components:

- formulating questions
- gathering and organizing information, evidence, or data
- interpreting and analyzing information, evidence, or data
- evaluating information, evidence, or data, and drawing conclusions
- communicating findings

Using this approach, teachers facilitate the learning process. Students initiate questions; gather, organize, interpret, and analyze information; evaluate findings and draw conclusions; and communicate their learning. The process focuses on students' self-reflections as they ask questions, discover answers, and communicate their understanding.

An inquiry approach begins with more structured inquiry, moves to guided inquiry, and, finally, leads to open inquiry:

Structured Inquiry	■ The teacher provides the initial question and structures the procedures to answer it. ■ Students follow the procedures and draw conclusions to answer the question.
Guided Inquiry	■ The teacher provides the initial question. ■ Students are involved in designing ways to answer the question and communicate their findings.
Open Inquiry	■ Students formulate their own question(s), design and follow through with a developed procedure, and communicate their findings and results.

NOTE: According to Colyer, Cariglia-Bull, Davis, Simpson, and Swift (2024), "Inquiry involves the most natural ways primary students learn at early stages of cognitive development. They can ask questions, seek answers and share their discoveries. The primary grades are the foundation for inquiry at a later level when students can think more abstractly." Facilitating inquiry requires careful observation and assessment by teachers to ensure students are ready for open inquiry. Open inquiry is not commonly implemented in grade 1 classrooms, as students are still in the development stage of building research skills.

Cultural Connections

To acknowledge and celebrate the cultural diversity represented in Canadian schools, infuse cultural connections into classroom learning experiences. Be aware of the cultural makeup of your class and celebrate students'

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diverse cultures by making connections to curricular outcomes. Also, include other cultures represented in the community and beyond to encourage intercultural understanding and harmony.

Find suggestions throughout ***Hands-On Science*** for connecting science topics to cultural explorations and activities.

Indigenous Ways of Knowing, Being, and Doing

Infuse Indigenous knowledge into the learning experiences of all students. The worldviews of Indigenous Peoples and their approaches and contributions to science are now being acknowledged and incorporated into science education. The intentional integration of Indigenous knowledge in ***Hands-On Science*** helps to address the Calls to Action of the Truth and Reconciliation Commission of Canada, particularly the calls to "integrate Indigenous knowledge and teaching methods into classrooms" (Action 62) and "build student capacity for intercultural understanding, empathy and mutual respect" (Action 63).

NOTE: ***Mamàhtawisiwin: The Wonder We Are Born With*** **and its accompanying toolkit are valuable resources when exploring Indigenous perspectives and knowledge. See <https://www.edu.gov.mb.ca/iee/mamahtawisiwin.html>.**

The Traditional Territories of Indigenous Peoples cover the entirety of what is now known as Manitoba. It is important to recognize the diversity of Indigenous Peoples in Manitoba and to focus on both the traditions and contemporary lives of the Indigenous communities in your area. Contact your division's personnel—Indigenous education leads and consultants, and Indigenous Education Councils—to find out what resources (e.g., people, books, videos) are available. Many such resources are featured in ***Hands-On Science***.

NOTE: To enhance your own understanding of Indigenous Peoples, and of Indigenous scientists in particular, consider watching the movie *Wilfred Buck*. This is an autobiographical documentary on the challenges and successes of a Manitoba Elder who views science from a holistic perspective. The movie is available through the National Film Board at <https://collection.nfb.ca/film/wilfred-buck>.

Another useful resource is the book *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants* by Robin Wall Kimmerer (2020). It offers valuable information on the interconnection between Indigenous perspectives and science.

Indigenous Peoples have depended on the land since time immemorial. The environment—including geography, vegetation, climate, and natural resources—shapes their ways of life. Indigenous Peoples acknowledge the importance of animals, land, and water, as they are integral to their worldview. There is also an understanding of reciprocity, in terms of what you can give back to the land or to other living things, including people. Since they observe the land and its inhabitants, the environment teaches Indigenous Peoples to survive and determines the methods they use to do so. The land continues to shape Indigenous Peoples' way of life today because of their ongoing, deep connection to it. Cultural practices, stories, languages, and knowledge originate from the land.

NOTE: When implementing land-based learning, opportunities abound to consider Indigenous ways of knowing, being, and doing. (See page 19 for more information about land-based learning.) Outdoor learning provides an excellent opportunity to highlight the importance of place. For example, using a map of the local area, have students identify the location of the land-based learning on the map in relation to the school. This will help students develop a stronger image of their community and surrounding area.

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Identify on whose Traditional Territory the school is located and where any land-based learning occurs, as well as the traditional names for these locations. The following sites provide maps of First Nations in Manitoba to use for this purpose:

- First Nations and Treaty Areas in Manitoba <https://sac-isc.gc.ca/eng/1100100020576/1616073943706>
- Map of First Nations in Manitoba <https://sac-isc.gc.ca/eng/1647441764240/1647441858948>
- First Nation Profiles Interactive Map <https://geo.sac-isc.gc.ca/cippn-fnpim/index-eng.html>

In addition, the Manitoba First Nations Education Resource Centre has a wide variety of resources on Manitoba Indigenous communities. One such resource is:

- Traditional First Nations Community Names Map <https://mfnerc.org/community-map/>

Incorporate a land acknowledgment once students have learned whose territory the school and land-based learning location is on.

NOTE: Many Manitoba school divisions have established protocols for land acknowledgments. Check with your division's Indigenous education leads and consultants to see if there are specific protocols to follow.

When incorporating Indigenous perspectives in the classroom, it is important to value Traditional Ecological Knowledge:

> Traditional Ecological Knowledge, or TEK, is the most popular term to denote the vast local knowledge First Peoples have about the natural world found in their traditional environment. […] TEK is, above all, local knowledge based in people's relationship to place. It is also holistic, not subject to the segmentation of Western science. Knowledge about a specific plant may include understanding its life cycle, its spiritual connections, its relationship to the seasons and with other plants and animals in its ecosystem, as well as its uses and its stories. (First Nations Education Steering Committee and First Nations Schools Association, 2019, p. 13)

Indigenous Peoples developed technologies and survived on this land for millennia because of their knowledge of the land. Through observation and experimentation, Indigenous Peoples refined technologies, such as building canoes and sweat lodges and discovering food-preservation techniques. Accordingly, TEK serves as an invaluable resource for science students and teachers.

Science describes the complex relationships in our world and environment, and we are all participants in this ongoing relationship. Like Western sciences, Indigenous Peoples' knowledges rely on empirical data, experimental procedures, and making predictions. However, Indigenous Peoples' knowledges often take a more holistic view. For example, this is reflected in the process of dyeing porcupine quills that can be used to adorn clothing. When harvesting the quills, consideration and care are shown for the animals. Special honour and gratitude are given for the sacrifice of life that is made so that humans can benefit from having these materials to work with. A quillworking artist uses different berries and plants to make dyes in a variety of colours. If a dyed quill is cut open, the core remains the original colour. When the quillwork is exposed to the sun over the years, the colours fade, and the quills return to their original state.

Throughout ***Hands-On Science***, there are many opportunities to incorporate culturally appropriate teaching methodologies from an Indigenous worldview. Making connections to the local community is essential to learning about Indigenous knowledge and ways of knowing. As one example, Elders and Knowledge Keepers offer a wealth of knowledge that can be shared with students. Consider

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inviting a local Elder or Knowledge Keeper into the classroom as a guest in connection with specific topics being studied. An Elder or Knowledge Keeper can guide a nature walk, share stories and experiences, describe traditional technologies, and help students understand Indigenous Peoples' perspectives of the natural world. Elders and Knowledge Keepers will provide guidance for learners and opportunities to build bridges between the school and the Indigenous community.

NOTE: In ***Hands-On Science***, the term *Knowledge Keeper* refers to individuals who may or may not be recognized as Elders, but who carry the teachings of their community and can be called upon for that expertise.

It is especially important to connect with Indigenous communities, Elders, and Knowledge Keepers in your local area, and to study local issues related to Indigenous Peoples in Manitoba. Consider contacting the Indigenous education lead or consultant in your school division, your local Indigenous Education Council, or the Manitoba Department of Education to access referrals. Also consider contacting local Indigenous organizations for referrals to Elders and Knowledge Keepers. Such organizations may also be able to offer resources and opportunities for field trips and land-based learning.

Here are a few suggestions for working with Elders and Knowledge Keepers:

- Elders and Knowledge Keepers have a deep spirituality that influences every aspect of their lives and teachings. They are recognized because they have earned the respect of their community through wisdom, harmony, and balance in their actions and teachings (see Indigenous Corporate Training, 2012).
- Some Indigenous keepers of knowledge are more comfortable being called "Knowledge Keepers" than "Elders." Be sensitive to their preference. Some communities have "Junior Elders" who may also be invited to share their knowledge with students and school staff.
- Elders and Knowledge Keepers may wish to speak about what seems appropriate to them, instead of being directed to talk about something specific. Respect this choice and refrain from being directive about what an Elder or Knowledge Keeper will talk about or share during their visit.
- Properly acknowledge visiting Elders or Knowledge Keepers and their knowledge, as they have traditionally been and are recognized within Indigenous communities as highly esteemed individuals.

NOTE: Elders, Knowledge Keepers, and Indigenous communities make significant contributions when they share their traditional knowledge. In their culture of reciprocity, this understanding should extend past giving a gift or honorarium to an Elder or Knowledge Keeper for sharing sacred knowledge. Think deeply about reciprocity and how to go beyond inviting Indigenous guests to your classroom. Expand your own learning and become connected to Indigenous people by, for example, engaging in Indigenous community events, working with the education department of local Nations, or exploring ways to continue developing the relationship between the local Nations and teachers in your division.

NOTE: Indigenous resources recommended in ***Hands-On Science*** are considered authentic resources. This means they were written by a First Nations, Métis, or Inuit author. Resources based on traditional stories reference the Indigenous community they came from and state the individual who shared the story and gave permission for the story to be used publicly, and the person sharing the story is First Nations, Métis, or Inuit. Connect with your school division's Indigenous Education Lead for other approved resources.

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Grade 1 Learning Outcomes

Strand A: Indigenous Knowledge Systems	
Indigenous Knowledge Systems	SCI.1.A.1 Demonstrate an understanding of different First Nations, Métis, and Inuit ways of knowing, being, and doing in relationship with the land and the natural world by exploring Indigenous methods of observing and interpreting the world, applying scientific principles, and creating technologies within local traditional and contemporary cultural contexts.
Strand B: Science Identity	
Science Identity	SCI.1.B.1 Develop a sense of agency, identity, and belonging in science by ■ cultivating natural curiosity about the world ■ acquiring scientific skills and fostering scientific attitudes ■ building a personal connection to nature ■ establishing links between science concepts and personal experience ■ recognizing that everyone can contribute to science
Strand C: Practical Science	
Science, Technology, Society, and Environment (STSE) Contexts	SCI.1.C.1 Demonstrate an awareness of the dynamic interplay between science, technology, society, and the environment (STSE), empowering learners to critically evaluate the impacts of scientific and technological advancements on individuals, communities, and ecosystems, and to make informed decisions for a sustainable future.
Scientific Measurement	SCI.1.C.2 Demonstrate an understanding of units, measuring tools, and the nature of measurement in science.
Action and Practice	SCI.1.C.3 Demonstrate practical scientific skills through safely and actively participating in a variety of scientific practices such as inquiry-based learning experiences, experimentation, scientific observation, data analysis, measurement, debate, communicating scientific information, and designing and building.
Scientific Instruments	SCI.1.C.4 Demonstrate an understanding of the purpose and functioning of various scientific instruments and materials (considering availability and appropriateness), as well as competence in using them safely.
Careers, Hobbies, and Activities	SCI.1.C.5 Demonstrate an understanding of the connections between the scientific ideas studied and a range of careers, hobbies, and activities.
Strand D: Nature of Science	
Method	SCI.1.D.1 Demonstrate an understanding that everyone can ask questions about the world and try to explain what is happening.
Application	SCI.1.D.2 Demonstrate an understanding that technologies have been created by people to provide things that we need or can use.

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Strand E: Scientific Knowledge	
Matter	SCI.1.E.1 Demonstrate an understanding that matter is all the "stuff" around us, which has mass, and takes up space.
	SCI.1.E.2 Demonstrate an understanding that types of matter can be distinguished by their properties.
	SCI.1.E.3 Demonstrate an understanding that the properties of materials make them fit for different purposes.
Energy	SCI.1.E.4 Demonstrate an understanding that energy is required to make events happen and cause changes.
	SCI.1.E.5 Demonstrate an understanding that there are many sources of energy.
Space Science	SCI.1.E.6 Demonstrate an understanding that there are patterns, or cycles, in the position of the Sun seen at different times of the day, and in the shape of the Moon as time passes.
	SCI.1.E.7 Demonstrate an understanding that daily and seasonal changes relate to the amount of solar energy reaching the Earth.
	SCI.1.E.8 Demonstrate an understanding of how seasonal changes affect living things.
Life Systems	SCI.1.E.9 Demonstrate an understanding of characteristics of living things that make them different from nonliving things.
	SCI.1.E.10 Demonstrate an understanding that living things have basic needs (e.g., energy, water, space, temperature) found in their environment.
Evolution	SCI.1.E.11 Demonstrate an understanding of the large diversity of living things on Earth.
	SCI.1.E.12 Demonstrate an understanding that many kinds of living things that once lived are now extinct.

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How to Use *Hands-On Science* in Your Classroom

Unit Overview

Hands-On Science for Manitoba, Grade 1 is organized into four units that address the Guiding Questions and Big Ideas.

Unit	Guiding Questions	Big Ideas
1. Properties of Matter	■ What is matter and how is it used?	**Matter:** All matter in the Universe is made up of very small particles.
2. What Is Energy?*	■ What is energy?	**Energy:** The total amount of energy in the Universe is always the same but can be transferred from one energy store to another during an event. **Evolution:** The diversity of organisms, living and extinct, is the result of evolution.
3. Patterns in the Sky and on Earth	■ What are seasonal changes and how do they affect various living things? ■ What is matter and how is it used?	**Space Science:** Our Solar System is a very small part of one of billions of galaxies in the Universe.
4. Needs and Variety of Living Things*	■ What are seasonal changes and how do they affect various living things? ■ What is energy?	**Life Systems:** Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. **Evolution:** The diversity of organisms, living and extinct, is the result of evolution.

***NOTE: Evolution is integrated into Unit 2: What Is Energy? and Unit 4: Needs and Variety of Living Things.**

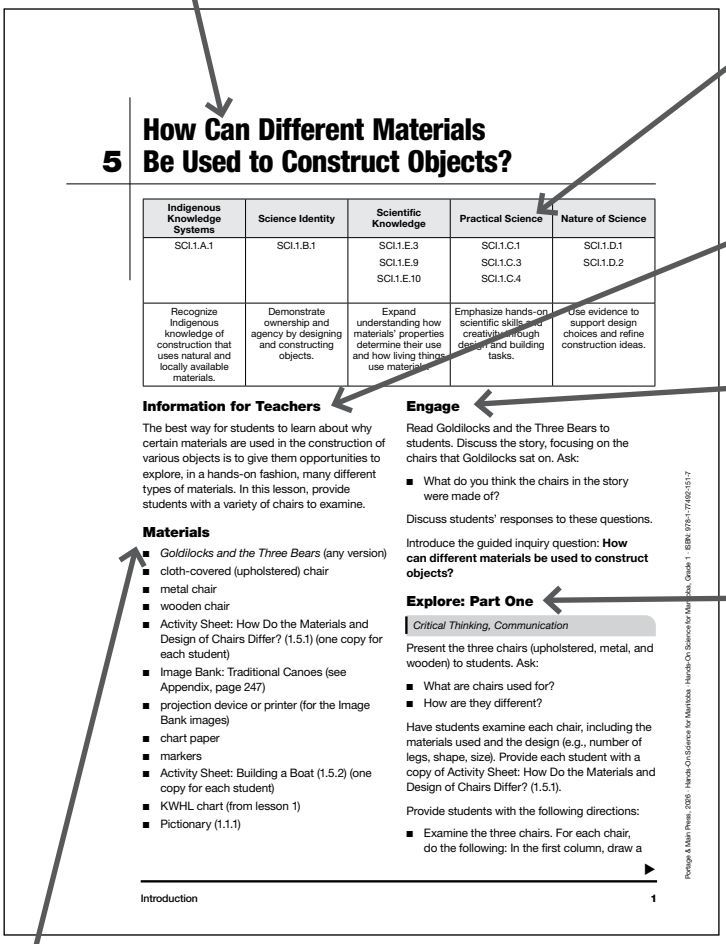
Each unit opens with About This Unit, an introduction to the unit that summarizes the topics covered and the general goals for the unit. About This Unit provides background information for teachers, planning tips, and lists of vocabulary related to the learning outcomes, as well as other pertinent information, such as how to embed Indigenous perspectives into student learning.

Additionally, About This Unit includes lists of related resources (e.g., books, videos, annotated websites) suitable for students.

Each unit is organized into lessons composed of topics and activities based on the Big Ideas and learning outcomes. Lessons are arranged in the following format:

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Lesson Title
- posed as a guided inquiry question related to the learning outcomes addressed in the lesson



5 How Can Different Materials Be Used to Construct Objects?

Indigenous Knowledge Systems	Science Identity	Scientific Knowledge	Practical Science	Nature of Science
SCI.1.A.1	SCI.1.B.1	SCI.1.E.3 SCI.1.E.9 SCI.1.E.10	SCI.1.C.1 SCI.1.C.3 SCI.1.C.4	SCI.1.D.1 SCI.1.D.2
Recognize Indigenous knowledge of construction that uses natural and locally available materials.	Demonstrate ownership and agency by designing and constructing objects.	Expand understanding how materials' properties determine their use and how living things use materials	Emphasize hands-on scientific skills and creativity through design and building tasks.	Use evidence to support design choices and refine construction ideas.

Information for Teachers

The best way for students to learn about why certain materials are used in the construction of various objects is to give them opportunities to explore, in a hands-on fashion, many different types of materials. In this lesson, provide students with a variety of chairs to examine.

Materials
- *Goldilocks and the Three Bears* (any version)
- cloth-covered (upholstered) chair
- metal chair
- wooden chair
- Activity Sheet: How Do the Materials and Design of Chairs Differ? (1.5.1) (one copy for each student)
- Image Bank: Traditional Canoes (see Appendix, page 247)
- projection device or printer (for the Image Bank images)
- chart paper
- markers
- Activity Sheet: Building a Boat (1.5.2) (one copy for each student)
- KWHL chart (from lesson 1)
- Pictionary (1.1.1)

Engage

Read Goldilocks and the Three Bears to students. Discuss the story, focusing on the chairs that Goldilocks sat on. Ask:
- What do you think the chairs in the story were made of?

Discuss students' responses to these questions.

Introduce the guided inquiry question: **How can different materials be used to construct objects?**

Explore: Part One

Critical Thinking, Communication

Present the three chairs (upholstered, metal, and wooden) to students. Ask:
- What are chairs used for?
- How are they different?

Have students examine each chair, including the materials used and the design (e.g., number of legs, shape, size). Provide each student with a copy of Activity Sheet: How Do the Materials and Design of Chairs Differ? (1.5.1).

Provide students with the following directions:
- Examine the three chairs. For each chair, do the following: In the first column, draw a

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Introduction 1

Outcomes Chart
- outlines the learning outcomes focused upon in the lesson

Information for Teachers
- provides basic scientific knowledge needed for the activities

Engage
- activates background knowledge, piques students' curiosity about related concepts, and introduces the lesson's guided inquiry question

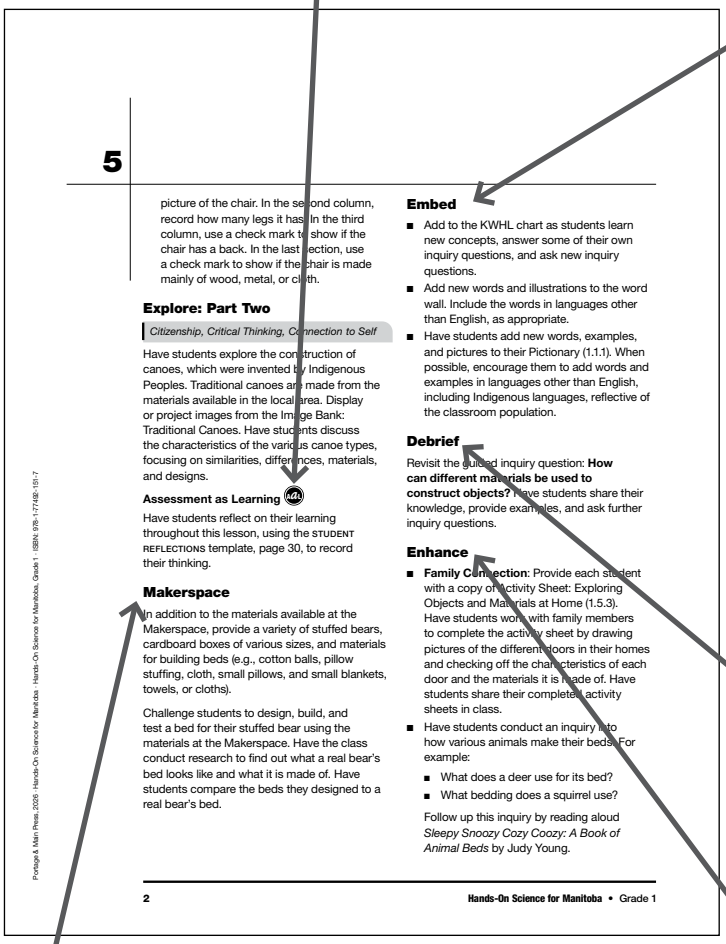
Explore
- details a step-by-step procedure, including higher-level questioning techniques and suggestions for encouraging the development of new knowledge and skills
- identified as Explore: Part One, Explore: Part Two, and so on (when there is more than one Explore activity in a lesson)
- focuses directly on the Big Ideas and related learning outcomes
- identifies the global competencies emphasized in each activity

Materials
- lists all materials required to conduct the main activities
- includes items for display purposes or for recording students' ideas
- suggests visual materials (e.g., large pictures, sample charts, diagrams) to assist in presenting ideas and questions and to encourage discussion
- connects to Image Bank visuals, which may be printed or projected for specific activities (see Appendix on page 235 for thumbnails and free access)

NOTE: Consider recording the guided inquiry question for display (e.g., on a sentence strip) so students can refer to it during activities and discussion.

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Assessment *For*, *As*, and *Of* Learning
- provides suggestions for authentic assessment, which includes assessment for learning, assessment as learning, and assessment of learning
- focuses on the learning outcomes related to the particular lesson (assessment strategies are outlined in the ***Hands-On Science*** Assessment Plan on page 26)



5

picture of the chair. In the second column, record how many legs it has. In the third column, use a check mark to show if the chair has a back. In the last section, use a check mark to show if the chair is made mainly of wood, metal, or cloth.

Explore: Part Two

Citizenship, Critical Thinking, Connection to Self

Have students explore the construction of canoes, which were invented by Indigenous Peoples. Traditional canoes are made from the materials available in the local area. Display or project images from the Image Bank: Traditional Canoes. Have students discuss the characteristics of the various canoe types, focusing on similarities, differences, materials, and designs.

Assessment as Learning

Have students reflect on their learning throughout this lesson, using the STUDENT REFLECTIONS template, page 30, to record their thinking.

Makerspace

In addition to the materials available at the Makerspace, provide a variety of stuffed bears, cardboard boxes of various sizes, and materials for building beds (e.g., cotton balls, pillow stuffing, cloth, small pillows, and small blankets, towels, or cloths).

Challenge students to design, build, and test a bed for their stuffed bear using the materials at the Makerspace. Have the class conduct research to find out what a real bear's bed looks like and what it is made of. Have students compare the beds they designed to a real bear's bed.

Embed
- Add to the KWHL chart as students learn new concepts, answer some of their own inquiry questions, and ask new inquiry questions.
- Add new words and illustrations to the word wall. Include the words in languages other than English, as appropriate.
- Have students add new words, examples, and pictures to their Pictionary (1.1.1). When possible, encourage them to add words and examples in languages other than English, including Indigenous languages, reflective of the classroom population.

Debrief

Revisit the guided inquiry question: **How can different materials be used to construct objects?** Have students share their knowledge, provide examples, and ask further inquiry questions.

Enhance
- **Family Connection**: Provide each student with a copy of Activity Sheet: Exploring Objects and Materials at Home (1.5.3). Have students work with family members to complete the activity sheet by drawing pictures of the different doors in their homes and checking off the characteristics of each door and the materials it is made of. Have students share their completed activity sheets in class.
- Have students conduct an inquiry into how various animals make their beds. For example:
  - What does a deer use for its bed?
  - What bedding does a squirrel use?

  Follow up this inquiry by reading aloud *Sleepy Snoozy Cozy Coozy: A Book of Animal Beds* by Judy Young.

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Embed
- suggests activities that review the main ideas of the lesson, focusing on learning outcomes, global competencies, and enduring understandings
- offers ways for students to demonstrate what they have learned through consolidation and reflection, allowing for synthesis and application of inquiry and new ideas
- embeds learning by adding to graphic organizers; having students record, describe, and illustrate new vocabulary and communicate investigations and ideas in a science journal; and adding new science vocabulary to the classroom word wall
- provides opportunities to reflect the cultural diversity of the classroom and the community by including new terminology in languages other than English, including Indigenous languages

Debrief
- provides students with opportunities to embed learning by revisiting the guided inquiry questions

Enhance
- encourages active participation and learning through Family Connections—prompts that students complete at home with their family members, then bring back to school to share
- suggests additional optional activities to extend, enrich, and reinforce the outcomes

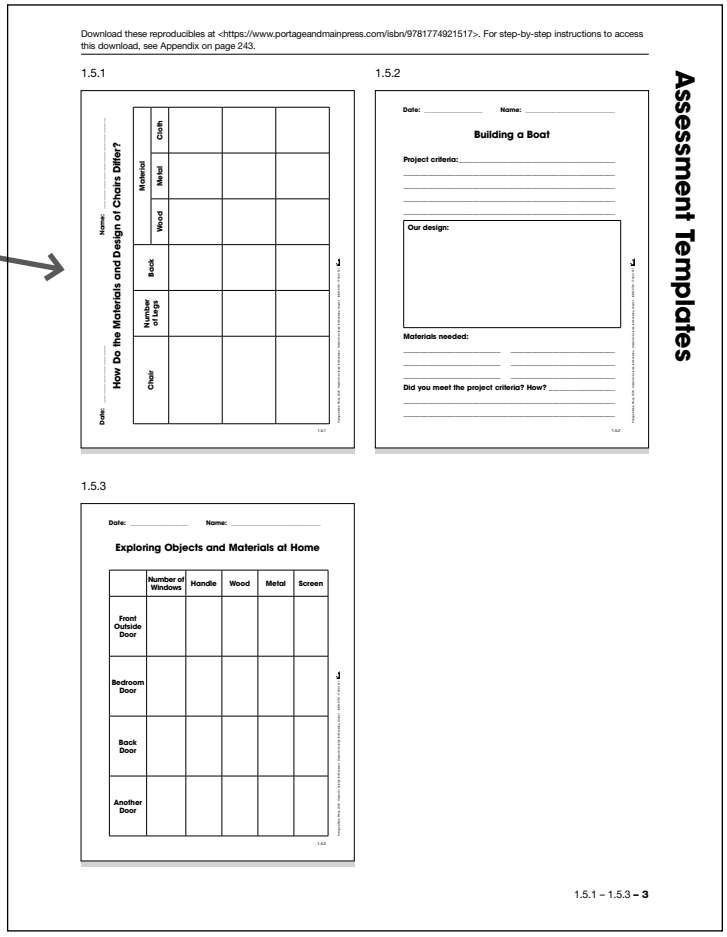
Makerspace
- focuses directly on practical scientific skills and knowledge, and the application of Big Ideas and learning outcomes
- addresses science concepts and skills and promotes personalized learning, open inquiry, discovery, creation, and innovation related to the unit outcomes
- suggests materials, equipment, and challenges related to the specific science topics of study, while correlating with other subject areas

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Reproducibles

- included as thumbnails following the lesson and can be downloaded by following the step-by-step instructions on page 235
- used to guide activities, record data, or serve as a template for designing and constructing graphic organizers
- completed by individual students, pairs of students, or small working groups, or projected and completed together as a class

NOTE: Activity sheets are meant to be used only in conjunction with, or as a follow-up to, the hands-on activities. The activity sheets are not intended to be the science lesson in itself or the sole assessment for the lesson.



Download these reproducibles at <https://www.portageandmainpress.com/isbn/9781774921517>. For step-by-step instructions to access this download, see Appendix on page 243.

Assessment Templates

1.5.1

Name: _____

Date: _____

How Do the Materials and Design of Chairs Differ?

Chair	Number of Legs	Back	Material: Wood	Material: Metal	Material: Cloth

1.5.1

1.5.2

Date: _____ Name: _____

Building a Boat

Project criteria: _____

Our design:

Materials needed:

Did you meet the project criteria? How? _____

1.5.2

1.5.3

Date: _____ Name: _____

Exploring Objects and Materials at Home

	Number of Windows	Handle	Wood	Metal	Screen
Front Outside Door					
Bedroom Door					
Back Door					
Another Door					

1.5.3

1.5.1 – 1.5.3 – 3

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Makerspaces

In keeping with an emphasis on practical knowledge (science, technology, society, and environment [STSE]), as well as action and practice through practical scientific skills, ***Hands-On Science*** includes opportunities to explore the interconnections between science and technology through Makerspace projects. This focus helps students become scientifically literate, as such learning integrates and applies concepts and processes through problem solving and design challenges. The skills students develop through these challenges include innovation, computational thinking, and engineering and scientific design. In addition, the six global competencies—Critical Thinking, Creativity, Citizenship, Connection to Self, Collaboration, and Communication—play a substantial role in the learning experience at the Makerspace.

NOTE: Work in a Makerspace also addresses many Practical Science and Nature of Science outcomes of the Manitoba science curriculum.

A Makerspace is a creative do-it-yourself environment where students pose questions, share ideas, and explore hands-on projects. In the school setting, a Makerspace is usually cross-curricular and allows for inquiry, discovery, and innovation. Sometimes the Makerspace is housed in a common area, such as the library, which means it can be used by the whole school community.

A classroom Makerspace is usually designed as a centre where students use knowledge, concepts, and skills acquired in a particular lesson and apply them to specific challenges. As students work on Makerspace projects, they are learning together and collaborating on cross-curricular or classroom themes.

Practical scientific skills and knowledge are infused throughout ***Hands-On Science***. Many lessons offer suggestions for Makerspace projects designed to develop students' skills in direct relation to the lessons. When students engage in this kind of learning, they actively work in teams, collaborating to find solutions to real-world problems using science, technology, engineering, and mathematics. They use a variety of materials and technologies to innovate and create. They draw plans, gather materials, build prototypes, and test what they have built. They conduct experiments, take measurements, and record their observations. Students also use digital technology to create new content, such as photos, videos, digital presentations, animations, and games. They reflect on their work and understand that there are many possible solutions to a problem. The Makerspace approach is student centred, with the teacher acting as facilitator of the learning. During Makerspace activities, the classroom is humming with excitement as students discuss their ideas, find solutions, and share their work.

NOTE: Older students can also act as mentors during Makerspace activities. The practice of mentorship spans many cultures, including many Indigenous cultures.

To address practical scientific skills and knowledge and to promote personalized learning, each unit of ***Hands-On Science*** includes a variety of suggestions for Makerspace materials, equipment, and challenges related to the specific science topics of study, while correlating with other subject areas. Suggested materials and challenges are intended to support open inquiry, discovery, creation, and innovation related to the unit outcomes.

Remember that learning is not directed at the Makerspace. Rather, the goal is simply to create conditions for learning to happen and give students the opportunity to work with a variety of age-appropriate tools. In creating these

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conditions, the Makerspace may evolve to foster inquiry within a specific topic.

There is no list of required equipment that defines a Makerspace; however, some items should be included, such as paper, cardboard, everyday recycled materials, tape, and glue. Consider including reusable building materials, such as interlocking plastic building blocks, snap cubes, pattern blocks, and straws and connectors. Additionally, art and craft materials, such as construction paper, modelling clay, fabric, buttons, and pipe cleaners, are often integrated into Makerspace offerings.

Consider the following when planning and developing a Makerspace:

- Always address safety concerns, ensuring materials, equipment, and tools are safe for student use. Include safety gloves and goggles, as appropriate.
- Take space and storage needs into account. Mobile carts and/or bins are handy for storing raw materials and tools.
- Work with students to write a letter to parents/guardians to explain the purpose of the Makerspace and to ask for donations of materials.

Classroom Environment

The classroom setting is an important component of the learning process. An effective classroom environment is inclusive of the diverse backgrounds and learning needs of all students. The strengths students bring to school are identified and nurtured. At the same time, every student is supported so they can succeed. The classroom must also be a space that encourages inquiry and discussion. The following are suggestions to promote inquiry in the classroom:

- Encourage students to ask questions and to appreciate different perspectives.
- Foster a nonthreatening atmosphere in which all students are comfortable sharing.
- Provide lots of opportunities for students to reflect on questions, share ideas, and generate further questions for inquiry.
- Promote discussion with and between students, as they need to talk about ideas with each other and with the teacher to help make meaning.
- Model for students how to gather the information they need so they have an adequate foundation for discussion.
- Ensure questions are clear and vocabulary is appropriate to learners.
- Avoid dominating discussion.
- Provide equal opportunities for all learners to participate.
- Model good questions and questioning strategies.
- Guide students in discovering answers to questions.
- During class lessons, activities, and discussions, encourage students to listen to and respect various different cultural explanations and beliefs on a topic (even if they seem to contradict each other). This is an important skill that relates directly to the five strands of the Manitoba science curriculum.

An active environment—one that gently hums with students' purposeful conversations and activities—indicates that meaningful learning is taking place. When your class is studying a specific topic, display related objects and materials in the room, including student work; pictures, posters, maps, graphs, and charts made during activities; and anchor charts of important concepts, procedures, skills, or strategies that are co-constructed with students. Visuals serve as a source of information, reinforce concepts and skills that

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have been stressed during lesson activities, and support students who are visual learners. As a support throughout the unit, display charts outlining success criteria so that vocabulary and concepts are always visible to students.

Planning Units

Timelines

No two groups of students explore topics and materials at the same rate, and so planning the duration of lessons and units is an important responsibility of the teacher. In some cases, students will not complete a lesson's activities during one block of time. In addition, students may be especially interested in one topic and want to expand on it. Consider the individual needs of your class; there are no strict timelines for ***Hands-On Science***. However, spend time on every unit in the book so students focus on all the curriculum outcomes established for this grade level. Encourage students to find connections as they explore various units, to see how the Big Ideas relate to different topics.

Classroom Management

Hands-On Science provides students with many opportunities to participate in hands-on activities; they will benefit more from this type of primary experience than if you merely demonstrate the activities. Although hands-on activities are emphasized throughout this book, how these experiences are managed is up to the teacher, since it is you who ultimately determines how your students function best in the learning environment. In some cases, you may have all students manipulating materials individually; in others, you may choose to organize the class into small groups.

Organizing the class into small working groups of three or four students is the most productive and beneficial way to manage many activities. Group work encourages the development of social skills, enables all students to be active in the learning process, and can reduce the cost of materials and equipment. Students learn from their classmates while working in collaborative groups.

When your class is working in collaborative groups, it may be helpful to assign each student a role, as follows:

- **leader:** makes sure everyone in the group has an opportunity to share their ideas and opinions
- **recorder:** records the group's data, research, questions, and any other information on the lesson's activity sheets or charts
- **reporter:** reports the group's ideas, findings, or answers back to the class
- **collector:** collects and returns all materials needed for each activity

The quantity of materials required will depend on how you conduct activities. If students are working individually, you will need enough materials for each student. If students are working in groups, the materials required will be significantly reduced.

Classroom Safety

The nature of science, and of scientific experimentation, means that safety concerns do arise from time to time. In these instances, teachers may decide to demonstrate an activity themselves, while still encouraging as much student interaction as possible.

Land-Based Learning

Land-based learning replaces the classroom walls with the natural environment. Land-based learning offers all students first-hand opportunities to observe, explore, and investigate the land, waters, and atmosphere of the natural world. Land-based learning promotes

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a healthy interplay between society and nature and helps students envision a world where there is meaningful appreciation and respect for our natural environment—an environment that sustains all life forms. Many lessons in ***Hands-On Science*** incorporate land-based learning activities, ranging from a casual walk around the neighbourhood to examine trees to a more involved exploration of local waterways.

Have students take along land-based journals to communicate their learning while doing land-based activities. Use notebooks with sturdy covers or drawing paper and clipboards. Provide each student with a zipper-lock bag to carry their journal and journal supplies (e.g., pencils, sharpeners, pencil crayons [rather than markers, which will bleed if wet], stretch gloves [for journalling on cooler days]).

NOTE: A valuable land-based learning resource for teachers is the book *Renewal: Indigenous Perspectives on Land-Based Education In and Beyond the Classroom* (2025), edited by Christine M'Lot and Katya Adamov Ferguson, and available from Portage & Main Press.

Practical Scientific Skills: Guidelines for Teachers

Hands-On Science is based on a scientific inquiry approach. While involved in the lessons, students use a variety of practical scientific skills as they answer questions, solve problems, and make decisions. These skills are not unique to science, but are integral to students' acquisition of scientific literacy. They include initiating and planning, performing and recording, analyzing and interpreting, and communicating and working in teams.

To encourage students' development of practical scientific skills in specific areas, use the following guidelines.

Observing

Students learn to perceive characteristics and changes using all five senses. Encourage students to safely use sight, smell, touch, hearing, and taste to gain information about objects and events. Observations may be qualitative (e.g., texture, colour), quantitative (e.g., size, number), or both.

Observing includes:

- gaining information through the senses
- identifying similarities and differences, and making comparisons

Encourage students to communicate their observations in a variety of ways, including orally, in writing, by sketching labelled diagrams, and by capturing evidence digitally (e.g., using a camera or tablet).

Questioning

Generating thoughtful inquiry questions is an essential skill for students when participating in inquiry-based learning. Encourage students to be curious and to extend their questions beyond those posed to them.

Students should learn to formulate specific questions to investigate, then create, from a variety of possible methods, a plan to find answers to those questions.

Exploring

Students need ample opportunities to manipulate materials and equipment in order to discover and learn new ideas and concepts. During exploration, encourage students to use all of their senses and observation skills.

Oral discussion is also an integral component of exploration; it allows students to communicate their discoveries. At a deeper level, discussion allows students to make meaning by discussing inconsistencies/misconceptions and comparing/

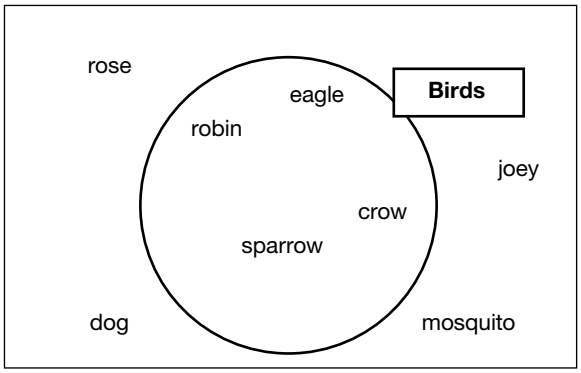
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contrasting their observations with others. This is the constructivist model of learning, which is essential in inquiry-based learning.

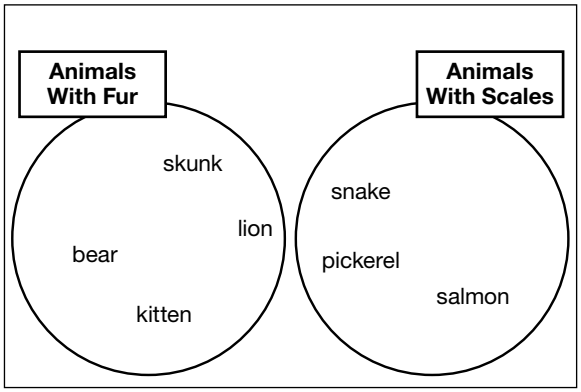
Classifying

Classification is used to group or sort objects and events and is based on observable properties. For example, objects can be classified into groups according to colour, shape, or size. Two strategies for sorting are the use of sorting mats and Venn diagrams. Sorting mats show distinct groups, while Venn diagrams intersect to show similar characteristics among sets.

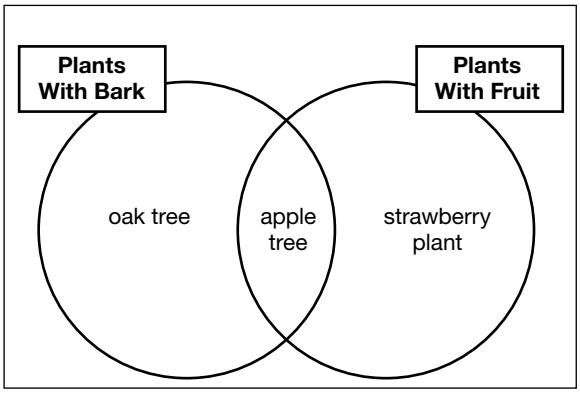
Single Sorting Mat



Double Sorting Mat



Double Venn



Measuring

Measuring is the process of discovering the dimensions or quantity of objects or events and, at the grade 1 level, involves comparing, ordering, and measuring objects by length, area, volume, or mass. This skill also includes measuring events using units of time (seconds, minutes, hours, and so on). In the early grades, measuring activities first involve the use of nonstandard units of measure; for instance, interlocking cubes or paper clips may be used to determine length. At this stage, students use nonstandard measurements as they build understanding of how to observe, compare, and communicate dimensions and quantity. This is a critical prelude to measuring with standard units.

An essential skill of measurement is estimating. Encourage students to estimate before they measure, whether in nonstandard or standard units. Estimation provides opportunities for students to take risks, use background knowledge, and enhance their measuring skills by comparing estimates and actual results.

NOTE: The Manitoba science curriculum includes explicit outcomes for measurement, which add new units and skills in a progressive manner throughout the grades.

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Communicating, Analyzing, and Interpreting

In science, communication is achieved through diagrams, graphs, charts, maps, models, and symbols, as well as written and spoken language. Communicating includes:

- reading and interpreting data from tables and charts
- constructing tables and charts
- reading and interpreting data from pictographs
- constructing pictographs
- constructing labelled diagrams
- constructing models
- using oral and written language
- sequencing and grouping events, objects, and data according to attributes

When presenting students with charts and graphs, or when students make their own charts and graphs as part of a specific activity, the following guidelines should be followed:

- A **pictograph** has a title and information on one axis that denotes the items being compared. (Note that the first letter of each word of both the title and the axis text is capitalized.) There is generally no graduated scale or heading for the axis representing numerical values.

Favourite Dessert				
				
				
				
				
Cake	Pie	Ice Cream		

- A **tally chart** is a means of recording data as an organized count. The count is grouped in fives so the total can easily be determined by counting by fives.

Favourite Sport		
Sport	**Tally**	**Total**
baseball	𝍸 |	6
hockey	𝍸 𝍸	10
soccer	𝍸 𝍸 ||	12

- A **chart (table)** has an appropriate title, and both columns and rows need specific headings. In some cases, pictures can be used alongside or in place of words to make the chart easier for young students to understand. Charts can be made in the form of checklists or can include room for additional written information and data.

Checklist Chart

Which Substances Dissolve in Water?		
Substance	**Dissolves in Water**	**Does Not Dissolve in Water**
Beads		√
Sugar	√	
Drink Mix	√	
Rice		√
Pepper		√

Data Chart

Local Snowfall		
Month	**2023/2024 Snowfall (cm)**	**Average Snowfall (cm)**
October	7	5
November	9	8
December	23	20
January	29	25
February	16	18
March	11	10

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Communicating also involves using the language and terminology of science. Encourage students to use the appropriate vocabulary related to their investigations (e.g., *object, metal, pliable, absorbent, characteristic*). The language of science also includes terms such as *predict*, *infer*, *estimate*, *measure*, *experiment*, and *hypothesize*. Use this vocabulary regularly throughout all activities and encourage students to do the same. As students become proficient at reading and writing, they can also be encouraged to use this vocabulary in written form. In each unit, students develop whole-class glossaries (word walls) and their own pictionary (picture dictionary) in which they can record the terms they have learned and define them in their own words.

Predicting

Predicting refers to the question, "What do you think will happen?" For example, ask students to predict what they think will happen to a blown-up balloon that is placed in a basin of water. Provide opportunities for students to make predictions and for them to feel safe doing so.

Inferring

In a scientific context, *inferring* generally refers to asking why something occurs. For example, ask students to infer why a blown-up balloon floats when placed in a basin of water. Again, encourage students to take risks when making inferences. Instead of explaining scientific phenomena to them, give students opportunities to infer for themselves using a variety of perspectives, and to then build their knowledge through inquiry and investigation.

Inquiry Through Investigation and Experimentation

When investigations and experiments are conducted in the classroom, it is essential to plan and record both the process and the results. The traditional scientific method uses the following format:

- purpose: what we want to find out, or a testable question we want to answer
- hypothesis: a prediction; what we think will happen and why
- materials: what we used to conduct the experiment or investigation
- method: what we did
- results: what we observed and measured
- conclusion: what we found out
- application: how we can use what we learned, and how this new knowledge benefits me, my community, and the world

This method of recording investigations may be used in later school years. However, in primary grades, it is more useful to focus on a narrative style of reporting that includes the following:

- what we want to know
- what we think might happen
- what we used
- what we did
- what we observed
- what we found out

A simpler four-question narrative that includes the following questions may also be used with any age group:

1. What was I looking for? (Describe the question you were trying to answer or the hypothesis/prediction you were testing.)
2. How did I look for it? (Tell what you did. Include materials and method.)
3. What did I find? (Describe observations and data.)
4. What does this mean? (Draw conclusions and consider applications to real life.)

This narrative may be completed in a variety of ways: oral discussion as a class, recording

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findings as a class, having students use drawings and writing to communicate independently, or a combination of these.

Throughout ***Hands-On Science***, a variety of methods are used to encourage students to communicate the inquiry process, including those listed above. Concept maps and other graphic organizers are also used.

Inquiry Through Research

In addition to hands-on inquiry, research is another aspect of inquiry that involves finding, organizing, and presenting information related to a specific topic or question. Even at a young age, students can begin to research topics studied in class if they are provided with support and guidelines. This is also an effective way to integrate oral communication, reading, writing, and representing to address outcomes from the Manitoba English language arts curriculum.

Guided research is a teaching and learning strategy encouraged throughout ***Hands-On Science***. Guided research provides an opportunity for students to seek further information about subjects of inquiry, personal interests, or topics of their choice. Accordingly, students are empowered and engaged in the process. Guided research encourages students and teachers to do the following:

Students	Teachers
■ ask questions of interest related to a topic being studied by the class ■ choose resources ■ collect information ■ make a plan to present findings ■ present research in a variety of ways	■ provide opportunities for students to ask questions of personal interest ■ provide access to appropriate resources ■ model and support the research process ■ offer opportunities for students to present their findings in a variety of ways and to a variety of audiences

In ***Hands-On Science***, the approach to scientific inquiry and research is one of gradual release, where the teacher provides substantial support in initial inquiry experiences, and gradually presents students with more and more opportunities for directing their own research. Suggestions for guiding research are presented regularly throughout ***Hands-On Science***.

Online Considerations

As our technological world continues to expand at an accelerating rate and information is increasingly available online, students will turn to the internet more and more. Accordingly, ***Hands-On Science*** is replete with opportunities for students to use online resources for research and investigation. Discuss online safety protocols with students and be vigilant in supervising their internet use. Review websites and bookmark those that are appropriate for student use.

Discuss plagiarism with students; explain that copying information word for word—from a book, the internet, or any other resource—is wrong. Such information should usually be paraphrased in the student's own words (sometimes including short direct quotations marked as such), and the source of the information cited. Photos, drawings, figures, and other images found online should also only be used with permission and citation of the source. Alternatively, students can source images for which permission has already been granted for use, such as through Creative Commons Canada, a nonprofit organization that "promotes and enables the sharing of knowledge and creativity … [and] produces and maintains a free suite of licensing tools to allow anyone to easily share, reuse, and remix materials with a fair 'some rights reserved' approach to copyright." See <https://ca.creativecommons.net/>.

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Addressing Students' Early Literacy Needs

The inquiry process involves having students ask questions and conduct investigations and research to answer these questions. At the grade 1 level, students may benefit from support for research, reading, and writing.

Consider having volunteers, student mentors, or educational assistants help students during these processes. In some cases, such helpers may also scribe for students to communicate their findings.

References

Creative Commons Canada. https://ca.creativecommons.net/.

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The *Hands-On Science* Assessment Plan

Hands-On Science provides a variety of assessment tools that enable teachers to build a comprehensive and authentic daily assessment plan for students. Based on research about the value of quality classroom assessment (Davies, 2020), lessons include suggestions for authentic assessment, which includes assessment for learning, assessment as learning, and assessment of learning.

Assessment With Purpose in Mind

Manitoba's Assessment and Evaluation branch encourages teachers to weave assessment into their classroom practice to support learning, including through:

- practice
- descriptive feedback to students without judgment, marks, or grades
- goal setting
- self-assessment

In keeping with this approach, ***Hands-On Science*** provides a diverse assessment plan that offers students many opportunities to practise, receive descriptive feedback, set goals, and self-assess.

The primary purpose of assessment is to improve student learning. Assessment for learning provides students with descriptive feedback and coaching for improvement. Assessment as learning helps students self-assess by developing their capacity to set their own goals, monitor their own progress, determine next steps, and reflect on their learning. Assessment of learning is summative in nature and is conducted by teachers to identify student progress in relation to learning outcomes. The challenge is to integrate assessment seamlessly with other learning goals.

Important Note to Teachers

Throughout ***Hands-On Science***, suggestions are provided for assessment for learning, assessment as learning, and assessment of learning. Keep in mind that these are merely suggestions. Use the assessment strategies presented in a wide variety of ways, and build an effective assessment plan using these assessment ideas as well as your own valuable experiences as teachers.

Assessment *for* Learning

It is important to assess students' understanding before, during, and after a lesson. This information will help determine students' needs and plan next steps in instruction.

Begin by finding out what students already know. This will allow you to identify misconceptions students may have about science concepts and will help to make connections to new learning.

To assess students as they work, use the assessment for learning suggestions provided with many activities. While observing and conversing with students, consider using one or both of the following templates to record assessment for learning data:

- **Anecdotal Record:** To gain an authentic view of student progress, it is critical to record observations during lessons. The ANECDOTAL RECORD template (page 30) provides a format for recording observations about individuals or groups.
- **Individual Student Observations:** To focus more on individual students over a longer period, consider using the INDIVIDUAL STUDENT OBSERVATIONS template (page 30). This template provides more space for comments and is especially useful during conferences, interviews, or individual student performance tasks.

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Assessment *as* Learning

It is important for students to reflect on their own learning in relation to science. For this purpose, a STUDENT SELF-ASSESSMENT template is provided (page 30), as well as a STUDENT REFLECTIONS template (page 30).

In addition, use the SCIENCE JOURNAL (page 31) to encourage students to reflect on their own learning. Print several copies for each student, cut the pages in half, add a cover, and bind the pages together. Students can create their own title pages for their journals. For variety, have students use the blank reverse side of each page for other reflections, such as drawing or writing about:

- new science challenges
- favourite science activities
- real-life experiences with science
- new terminology
- new places explored during investigations

Students may also journal in other ways, such as by adding notes to their portfolios, or by keeping online science blogs or journals to record successes, challenges, and next steps relating to the learning goals.

NOTE: The SCIENCE JOURNAL template is provided as a suggestion, but journals can also be made from simple notebooks or recycled paper.

When working in groups, students will benefit from reflecting on their ability to listen to others respectfully, share ideas, and participate actively in the inquiry process. For this purpose, use the COLLABORATION SKILLS SELF-ASSESSMENT template (page 31).

Assessment *of* Learning

Assessment of learning provides a summary of student progress related to accomplishing the learning goals at a particular point in time.

To draw conclusions about what a student knows and can do, it is important to gather a variety of assessment data. Consider collecting student products, observing processes, and having conversations with students. Determine which student work is formative and which is summative, and use only the most recent and consistent evidence.

Assessment of learning suggestions are provided with the culminating lesson of each unit of ***Hands-On Science***. To record student results, use the ANECDOTAL RECORD template (page 30), the INDIVIDUAL STUDENT OBSERVATIONS template (page 30), and the RUBRIC (page 32).

Always assess a student's individual accomplishments, rather than the work they do in a group. However, you may assess how an individual student works within a group. Such skill development includes the ability to listen to others respectfully, share ideas, and participate actively in the inquiry process. For this purpose, use the COLLABORATION SKILLS TEACHER ASSESSMENT template (page 31).

Hands-On Science does not include tests and quizzes. Any formal assessment of students needs to be connected to the specific skills and concepts focused on during lessons, and since each teacher will select different activities from those provided within each lesson, assessment tasks will look different in each classroom.

Performance Assessment

Both assessment for learning and assessment of learning include performance assessment. Performance assessment is planned, systematic observation and assessment based on students actually doing a specific science activity. Use teacher- or teacher/student-created rubrics to assess student performance.

Use the SAMPLE RUBRIC and the RUBRIC template (page 32) for this assessment. For any specific

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activity, before the work begins, discuss with students the success criteria for completing the task. This will ensure the success criteria relate to the lesson's learning goals. Record these criteria on the rubric.

When conducting assessment for learning, review the rubric with students to determine strengths, challenges, and next steps related to learning goals.

When conducting assessment of learning, use the rubric to determine summative data. For example, when using the rubric criteria to assess student performance, students can receive a check mark for each criterion accomplished to determine a rubric score from a total of four marks. These rubric scores can then be transferred to the RUBRIC CLASS RECORD template (page 32).

Portfolios

A portfolio is a collection of work that shows evidence of a student's learning. There are many types of portfolios—the showcase portfolio and the progress portfolio are two popular formats. Showcase portfolios highlight the best of students' work, with students involved in selecting pieces and justifying their choices. Progress portfolios reflect students' progress as their work improves and aim to demonstrate in-depth understanding of the materials over time.

Select, with student input, work to include in a science portfolio or in a science section of a multi-subject portfolio. Selections should include representative samples of student work in all types of science activities.

Use the PORTFOLIO TABLE OF CONTENTS template (page 32) and PORTFOLIO ENTRY RECORD (page 33) to organize the portfolio.

Indigenous Perspectives on Assessment

From an Indigenous perspective, assessment is community-based, qualitative, and holistic, and includes input from all the people who influence an individual student's learning—parents, caregivers, Elders, Knowledge Keepers, community members, and teachers. An assessment that includes all these perspectives provides a balanced understanding of what represents success for Indigenous students and their family/community. A strong partnership between parents/guardians/community and school improves student achievement. Be aware that some Indigenous students may feel apprehensive about a formal process of assessment; others may find that Western achievement goals do not fit their worldview. In ***Hands-On Science***, consideration has been given to assessment from an Indigenous perspective. The following suggestions support this perspective:

- Consider learning and assessment in a holistic way, acknowledging that each student will find identity, meaning, and purpose through connections to the community, the natural world, and values such as respect and gratitude.
- Incorporate family and community in learning and assessment whenever possible. Include parents/caregivers, siblings, grandparents, aunts and uncles, cousins, and community members such as Elders, Knowledge Keepers, daycare staff, babysitters, and coaches. For this purpose, consider using the FAMILY AND COMMUNITY CONNECTIONS: ASSESSING TOGETHER template (page 31). After any lesson or module, students can take home a copy of this template to complete with family or community members (with permission). This template can also be

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completed by students in pairs, to enhance the sense of community in the classroom.

- Have students take home one of their self-assessment templates (STUDENT SELF-ASSESSMENT, STUDENT REFLECTIONS, SCIENCE JOURNAL, or COLLABORATION SKILLS SELF-ASSESSMENT) to explain it to a family or community member. These templates can also be shared with a peer to enhance the sense of community within the school.

References

Davies, Anne. *Making Classroom Assessment Work* (4th ed.). Courtenay, BC: Connections Publishing, 2020.

Government of Manitoba. *Rethinking Classroom Assessment With Purpose in Mind*, 2006. https://www.edu.gov.mb.ca/k12/assess/wncp/full_doc.pdf.

M'Lot, Christine and Katya Adamov Ferguson (Eds.). *Renewal: Indigenous Perspectives on Land-Based Education In and Beyond the Classroom*. Portage & Main Press, 2025.

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Anecdotal Record

Date: _____

Anecdotal Record

Purpose of Observation: _____

Student/Group	**Student/Group**
Comments	**Comments**
Student/Group	**Student/Group**
Comments	**Comments**
Student/Group	**Student/Group**
Comments	**Comments**

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Individual Student Observations

Date: _____

Individual Student Observations

Purpose of Observation: _____

Student: _____
Observations

Student: _____
Observations

Student: _____
Observations

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Student Self-Assessment

Date: _____ **Name:** _____

Student Self-Assessment

Looking at My Science Learning

1. What I did in science: _____

2. In science I learned: _____

3. I did very well at: _____

4. One science skill that I am working on is: _____

5. I would like to learn more about: _____

6. One thing I like about science is: _____

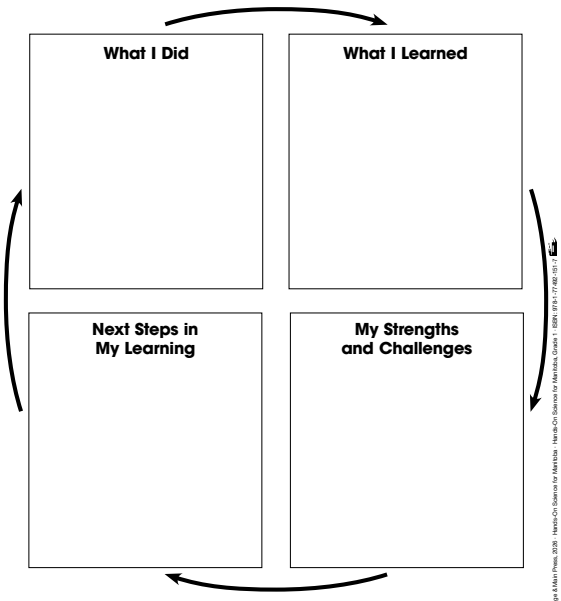
Note: The student may complete this self-assessment or the teacher can scribe for the student.

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Student Reflections

Date: _____ **Name:** _____

Student Reflections



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Unit 1

Properties of Matter

About This Unit

The Big Idea in this unit is matter:

> All matter in the Universe is made of very small particles.
>
> Atoms are the building blocks of all matter, living and nonliving. The behaviour and arrangement of the atoms explains the properties of different materials. In chemical reactions, atoms are rearranged to form new substances. Each atom has a nucleus containing neutrons and protons, surrounded by electrons. The opposite electric charges of protons and electrons attract each other, keeping atoms together and accounting for the formation of some compounds.

At the grade 1 level, the focus is on the following concept:

> All the "stuff" encountered in everyday life, including air, water, and different kinds of solid substances, is called matter because it has mass, and therefore weight on Earth, and takes up space. Different materials are recognisable by their properties, some of which are used to classify them as being in the solid, liquid, or gas state. (*Working With Big Ideas of Science Education* <https://www.interacademies.org/publication/working-big-ideas-science-education>)

NOTE: This information about the Big Idea is for teacher reference. Not all of this content is within the outcomes for grade 1 science.

Connecting Big Ideas

In this unit of ***Hands-On Science for Manitoba, Grade 1,*** students are introduced to concepts about matter and how matter is used through the exploration of various objects and structures in their immediate surroundings. *Matter* is anything that takes up space and has mass. Colour, odour, taste, weight, and hardness (rigidity) are some physical properties of matter. According to scientists, everything in our world is called *matter*. We are surrounded by objects made of matter or, more specifically, objects that are made of different materials.

Students will use their senses to identify various objects, structures, and materials, and, in doing this, they will learn to make a clear distinction between objects, structures, and materials. Students will learn that structures and objects are made from materials and that materials have specific properties. They will also learn to describe these properties clearly and precisely. By using various materials to make objects and structures, students will begin to understand the connection between the properties of materials and the specific purposes for which materials are used.

The Scientific Knowledge learning outcomes focused on in this unit are:

- **SCI.1.E.1**: Demonstrate an understanding that matter is all the "stuff" around us, which has mass, and takes up space.
- **SCI.1.E.2**: Demonstrate an understanding that types of matter can be distinguished by their properties (e.g., liquid, solid, gas, soft, hard, smooth, rough, heavy, light).
- **SCI.1.E.3**: Demonstrate an understanding that the properties of materials make them fit for different purposes (e.g., rubber for rain boots, strength for walls, softness for clothing).

SAFETY NOTE: Demonstrate proper scientific testing procedures for students. For example, when smelling a substance, students should not inhale fumes directly. Instead, demonstrate how to wave a hand over the substance toward their nostrils. In addition, students should not taste anything during experiments unless you have advised them that it is safe to do so. Sometimes, harmful but invisible substances are hidden in other materials (e.g., bleach in water).

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Planning Tips for Teachers

- The best way for students to learn about various objects and the materials they are composed of is to give students opportunities to explore many types of materials. Collect materials safe for students to handle, and provide items students can sort and classify. Store these materials in the classroom for students to access. Materials can include items such as:
  - paper (e.g., plates, napkins, wrapping paper, stickers)
  - plastics (e.g., cups, spoons, bags, empty pop bottles, jugs, food containers)
  - metals (e.g., spoons, paper clips, nails, screws, aluminum foil)
  - rubber (e.g., balls, erasers, balloons)
  - cloth (e.g., cotton, rayon, linen, nylon, flannel, felt)
  - wood (e.g., pencils, blocks, wooden spoons)
  - natural objects (e.g., branches, rocks, shells, feathers, fur, leather, birchbark, mud, sand, water, clay, leaves)
  - materials for sorting (e.g., Venn diagram mats, sorting mats, index cards for labelling)
- Collect a variety of relevant reading materials, including both fiction and nonfiction resources, at a range of reading levels appropriate for your class, and have these available for students to access.
- If possible, arrange computer time for students to explore appropriate websites. Always preview websites students may use.
- In lesson 2, students use cameras to document various materials inside and outside the school. Arrange for devices with cameras (one for each working group of students), ensuring that devices are charged and have sufficient memory. It may also be helpful to have volunteers present during this lesson to accompany groups of students to different areas around the school.
- Have students make land-based journals for use throughout the unit. Use notebooks with sturdy covers or drawing paper and clipboards. Provide each student with a zipper-lock bag to carry their journal and journal supplies (e.g., pencils, sharpeners, pencil crayons [rather than markers, which will bleed if wet], stretch gloves [for journalling on cooler days]).
- In lesson 7, students build with LEGO bricks. Ensure enough LEGO is on hand for students to complete the engineering design process activity (Explore: Part Two) for that lesson.
- Keep all charts and displays created during each lesson, as well as any other completed work. These are often referenced in subsequent lessons.
- Consider recording each lesson's guided inquiry question (e.g., on a sentence strip) for display throughout related investigations.
- Add unit-specific materials to the Makerspace that encourage learning about objects and materials, in addition to the general materials listed in the Introduction on page 17. Include items such as natural materials (e.g., leaves, sticks, rocks, sand, soil), as well as equipment (e.g., magnifying glasses, tweezers, measuring devices).
- Whenever possible, use reusable or recycled items for classroom experiments and demonstrations. For example, rather than single-use zipper-lock bags, use silicone or sturdy plastic bags that can be washed and reused.



SAFETY NOTE: Engage in a discussion about safety and respect at the Makerspace with students before beginning this unit. Consider small parts and potential hazards for students of all ages and abilities who will have access to the Makerspace.

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Indigenous Ways of Knowing, Being, and Doing

Incorporate Indigenous ways of knowing, being, and doing into lessons whenever possible. This unit provides many opportunities to:

- Invite Elders or Knowledge Keepers to share stories or teachings related to objects and structures.
- Invite Elders or Knowledge Keepers to lead land-based learning activities.
- Connect learning to traditional and local Indigenous knowledge and materials used in tools and daily life.
- Link learning to Indigenous ways of observing natural patterns and characteristics of materials.
- Use traditional Indigenous technologies and knowledge to offer context for material choice and function.

Science Vocabulary

Throughout this unit, use, and encourage students to use, vocabulary such as:

- *absorb, characteristic, cloth, flexible, join, material, matter, metal, object, plastic, pliable, recycle, reduce, reuse, rigid, smooth, solid, structure, texture, waterproof, wood*

For this unit, provide samples of materials such as wood, metal, plastic, and cloth. Provide objects as examples to show such characteristics as rigid and pliable. Such visual and tactile cues will enhance student understanding of these concepts.

Infuse vocabulary related to scientific inquiry skills into daily lessons. Display this vocabulary in the classroom throughout the year, as it relates to all science units.

Have students determine which skills they are being asked to use as they work through particular lessons. Discuss what the skill looks and sounds like as students explore and investigate. Vocabulary related to scientific and inquiry skills includes:

- *ask, brainstorm, collect, compare, construct, create, describe, estimate, explain, explore, find, follow, graph, identify, improve, investigation, match, measure, observe, order, plan, predict, record, research, select, test*

In lesson 1, have students start a pictionary—a picture dictionary in which they can record new vocabulary introduced throughout the unit.

Also in lesson 1, create a science word wall for the unit on a bulletin board, poster paper, or chart paper. Record new vocabulary on the word wall as it is introduced. Ensure the word wall is located where all students can see it and refer to the words during activities and discussion.

NOTE: Include terminology in languages other than English on the word wall and pictionary. This is a way of acknowledging and respecting students' cultural backgrounds, while enhancing learning for all students. Use resources such as Google Translate and Microsoft Translator to assist with this.

A variety of apps from Indigenous communities and organizations are available to translate terms to Indigenous languages. Try to use the dialect closest to your local area where possible.

For example:

- **Anishinaabemowin <https://apps.apple.com/ca/app/anishinaabemowin-niwasa/id1480794561>**
- **Oji-Cree <https://play.google.com/store/apps/details?id=com.languagepal.kobeojicreeandroid&hl=en_CA&gl=US>**

Online dictionaries are also available for languages other than English that may be reflective of the class population.

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Curriculum Correlation

Strand	Learning Outcomes	Lesson							
		1	2	3	4	5	6	7	8
A. Indigenous Knowledge Systems	**SCI.1.A.1** Demonstrate an understanding of different First Nations, Métis, and Inuit ways of knowing, being, and doing in relationship with the land and the natural world by exploring Indigenous methods of observing and interpreting the world, applying scientific principles, and creating technologies within local traditional and contemporary cultural contexts.	√	√	√	√	√	√	√	√
B. Science Identity	**SCI.1.B.1** Develop a sense of agency, identity, and belonging in science by ■ cultivating natural curiosity about the world ■ acquiring scientific skills and fostering scientific attitudes ■ building a personal connection to nature ■ establishing links between science concepts and personal experience ■ recognizing that everyone can contribute to science	√		√	√	√	√	√	√
C. Practical Science: **STSE Contexts**	**SCI.1.C.1** Demonstrate an awareness of the dynamic interplay between science, technology, society, and the environment (STSE), empowering learners to critically evaluate the impacts of scientific and technological advancements on individuals, communities, and ecosystems, and to make informed decisions for a sustainable future.	√	√		√	√	√	√	√
C. Practical Science: **Scientific Measurement**	**SCI.1.C.2** Demonstrate an understanding of the units, measuring tools, and nature of measurement in science. Include: ■ Tools: senses, nonstandard (e.g., hands, paper clips, coins), calendar, clock ■ Attributes: length, mass, volume, time ■ Units: length (relative: longer, shorter; nonstandard: hands, paper clips, coins, etc.), mass (relative: heavier, lighter; nonstandard: paper clips, coins, etc.), time (seconds, minutes, hours, days, weeks, months, years) ■ Skills: sort, compare, sequence based on a single attribute	√	√	√					

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Strand	Learning Outcomes	Lesson							
		1	2	3	4	5	6	7	8
C. Practical Science: **Action and Practice**	**SCI.1.C.3** Demonstrate practical scientific skills through safely and actively participating in a variety of scientific practices such as inquiry-based learning experiences, experimentation, scientific observation, data analysis, measurement, debate, communicating scientific information, and designing and building.	√	√	√	√	√	√	√	√
C. Practical Science: **Scientific Instruments**	**SCI.1.C.4** Demonstrate an understanding of the purpose and functioning of various scientific instruments and materials (considering availability and appropriateness), as well as competence in using them safely.	√	√	√		√			√
C. Practical Science: **Careers, Hobbies, and Activities**	**SCI.1.C.5** Demonstrate an understanding of the connections between the scientific ideas studied and a range of careers, hobbies, and activities.	√		√	√				√
D. Nature of Science: **Method**	**SCI.1.D.1** Demonstrate an understanding that everyone can ask questions about the world and try to explain what is happening.	√	√	√	√	√	√	√	√
D. Nature of Science: **Application**	**SCI.1.D.2** Demonstrate an understanding that technologies have been created by people to provide things that we need or can use.		√	√	√	√	√	√	√
E. Scientific Knowledge: **Matter**	**SCI.1.E.1** Demonstrate an understanding that matter is all the "stuff" around us, which has mass, and takes up space.	√							
	SCI.1.E.2 Demonstrate an understanding that types of matter can be distinguished by their properties.	√	√	√					
	SCI.1.E.3 Demonstrate an understanding that the properties of materials make them fit for different purposes.		√	√	√	√	√	√	√
E. Scientific Knowledge: **Life Systems**	**SCI.1.E.9** Demonstrate an understanding of characteristics of living organisms that make them different from nonliving things.					√			
	SCI.1.E.10 Demonstrate an understanding that living things have basic needs (e.g., energy, water, space, temperature) found in their environment.					√			

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Resources for Students

NOTE: Resources marked with an asterisk are considered authentic resources. This means they were written by a First Nations, Métis, or Inuit author. Resources that are based on traditional stories reference the Indigenous community they came from and state the individual who shared the story and gave permission for the story to be used publicly. The person sharing the story is First Nations, Métis, or Inuit. Connect with your school division's Indigenous education lead for other approved resources.

Books

Sumaya Solves the Ice Thief Problem, Aisha Amed (Capstone, 2025).

Agua, Agüita/Water, Little Water, Jorge Tetl Argueta (Piñata Books, 2017).*

Fuego, Fueguito/Fire, Little Fire/Tit, Titchin, Jorge Tetl Argueta (Piñata Books, 2017).*

Mîkiwâhp: The Traditional Tipi, Darlene Auger (Eschia Books, 2020).*

Mud!, Annie Bailey (Abrams Appleseed, 2022).

Let's Investigate Materials, Jacqui Bailey (Crabtree, 2021).

Home Is…, Hannah Rodgers Barnaby (Beach Lane Books, 2021).

Siha Tooskin Knows the Gifts of His People, Charlene and Wilson Bearhead (HighWater, 2020).*

Ada Twist, Scientist, Andrea Beaty (Abrams Books for Young Readers, 2016).

Jabari Tries, Gaia Cornwall (Candlewick, 2020).

Libby Loves Science: States of Matter, Kimberly Derting (Greenwillow Books, 2024).

48 Grasshopper Estates, Sara de Waal (Annick, 2021).

Matter: Physical Science for Kids, Andi Diehn (Nomad, 2018).

The Spacesuit: How a Seamstress Helped Put Man on the Moon, Alison Donald (Maverick Arts, 2019).

Cats Are a Liquid, Rebecca Donnelly (Henry Holt, 2019).

Métis Camp Circle: A Bison Culture Way of Life, Leah Marie Dorion (Gabriel Dumont Institute, 2019).*

The Three Little Superpigs: Once Upon a Time, Claire Evans (Scholastic, 2019).

Goldilocks and the Three Engineers, Sue Fliess (Albert Whitman, 2021).

Benjamin's Thunderstorm, Melanie Florence (Kids Can, 2023).*

Discover It Yourself: Solids and Liquids, David Glover (Kingfisher, 2021).

Lowanpi Mato's Tipi, Kim Soo Goodtrack and Stan Lethbridge (Strong Nations, 2020). *

No Lie, Pigs (and Their Houses) Can Fly! The Story of the Three Little Pigs as Told by the Wolf, Jessica Gunderson (Picture Window Books, 2017).

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- **https://playproject.org/creative-ideas-for-common-objects/**
  Creative Ideas for Common Objects—Play Project: Creative ways to repurpose common household items for play.
- **https://letstalkscience.ca/educational-resources/picture-collections/properties-materials**
  Properties of Materials—Let's Talk Science: Image bank showing objects that are hard, soft, flexible, rigid, rough, smooth, strong, fragile, buoyant, and non-buoyant.

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- **https://www.niehs.nih.gov/health/kids/topics/reduce**
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- **https://www.abcya.com/games/word_clouds**
  ABCya Word Clouds: Kid-friendly word cloud generator that allows users to customize fonts, layouts, and colours. Word clouds can be saved or printed for use in the classroom.
- **https://piccollage.com/**
  PicCollage: A free app for creating digital presentations that combine photos, text, and drawings.

Videos

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- **https://www.youtube.com/watch?v=-0ijMPvly-U**
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4 Why Are Some Materials Better Than Others for Certain Jobs?

Indigenous Knowledge Systems	Science Identity	Practical Science	Nature of Science	Scientific Knowledge
SCI.1.A.1	SCI.1.B.1	SCI.1.C.1 SCI.1.C.3 SCI.1.C.5	SCI.1.D.1 SCI.1.D.2	SCI.1.E.3
Examine traditional Indigenous technologies and knowledge for context on material choice and function.	Explore the relevance of science in decisions about material use.	Evaluate and test different materials in context, promoting inquiry. Initiate environment action. Explore careers and hobbies related to the scientific ideas being studied.	Generate explanations about why some materials work better than others.	Understand the suitability of materials for different jobs based on properties.

Materials

- apple (whole)
- potato (whole)
- chart paper
- markers
- kitchen utensils (paring, plastic, and butter knives; vegetable peeler; masher. For teacher use only.)
- six plates, labelled *A, B, C, D, E*, and *F*
- plastic food wrap
- paper towels
- timer
- Activity Sheet: Why Are Some Materials Better Than Others for Certain Jobs? (1.4.1) (one copy for each student)
- pencils
- crayons
- Image Bank: Tools Used by Indigenous Peoples (see Appendix, page 235)
- projection device (optional)
- computer/tablet with internet access (optional)
- KWHL chart (from lesson 1)
- Pictionary (1.1.1)

Engage

Have students observe and examine a whole apple and a whole potato. Ask them to describe the inside and outside of each.

Record these descriptions on chart paper. Have students compare and contrast the outside and the inside of the apple and the potato. Ask:

- How are the outside of the apple and the outside of the potato the same?
- How are they different?
- How are the inside of the apple and the inside of the potato the same?
- How are they different?

Next, focus on tools used to peel, cut, and mash the potato and the apple, but do not display the tools.

Ask:

- What might I use to cut up the potato and the apple?
- What might I use to peel them?
- What if I wanted to make mashed potatoes or applesauce? How could I mash them?

As each question is asked, have students discuss their background knowledge of the

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appropriate utensils (knife, peeler, and masher). Discuss the design of each and how it is used. Have students role-play peeling, cutting, and mashing the potato or the apple, but do not display the utensils.

Introduce the guided inquiry question: **Why are some materials better than others for certain jobs?**

Explore: Part One

Critical Thinking

SAFETY NOTE: For this activity, you will need to cut the potato and the apple into thirds. Review safety guidelines before using a knife, and remind students that they should not use sharp utensils.

Display—but do not identify—the kitchen utensils. Have students describe each knife and the peeler and predict which utensil is best for removing the skin from the apple and the potato. Record students' predictions on chart paper.

Test their predictions by trying to peel the apple and the potato with each knife and the peeler. Ask:

- Which utensil works best? Why?

Finish peeling the apple and the potato.

Ask students to predict which utensil is best for slicing the apple and the potato. Record their predictions on chart paper.

Test their predictions by trying to slice the apple and the potato into thirds with each knife and with the peeler. Ask:

- Which utensil works best? Why?

Finish slicing the apple and the potato into thirds. Have students observe and examine the slices. Ask:

- What do you think will happen if we leave these slices on the table for a long time?
- Why do you think this will happen?
- Why do you think the apple and the potato will turn brown?
- Can you think of a way we could stop the apple and the potato from turning brown?
- What could we use?

Have students share their predictions and ideas.

Place one third of the apple on a plate, uncovered. Label this plate *A*. Wrap another third of the apple in plastic wrap and place it on a second plate labelled *B*. Wrap the final third of the apple in paper towel and place it on a third plate labelled *C*. Place one third of the potato on a plate, uncovered. Label this plate *D*. Wrap another third of the potato in plastic wrap and place it on a plate labelled *E*. Wrap the final third of the potato in paper towel and place it on a plate labelled *F*.

On a sheet of chart paper, recreate the chart found on the Activity Sheet: Why Are Some Materials Better Than Others for Certain Jobs? (1.4.1).

Point to the word *prediction* and explain to students that a prediction is a guess about what will happen.

Have students predict what will happen to the apple and potato thirds if they are left on the plates for 20 minutes, 40 minutes, and 1 hour. Encourage students to use the term *prediction* as they answer. Record their predictions on the chart.

Give each student a copy of Activity Sheet: Why Are Some Materials Better Than Others for Certain Jobs? (1.4.1).

Have students complete the first column of the chart by drawing pictures to show what the apple and potato thirds on each of the six plates

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looked like immediately after being peeled and sliced into pieces. Then have students sketch, in the appropriate columns of their charts, what they predict the slices will look like on each plate after 20 minutes, after 40 minutes, and after 1 hour.

NOTE: According to the Manitoba science curriculum, grade 1 students should be introduced to standard units used to measure the passage of time. Nonetheless, exploring both nonstandard and standard time measurement can be valuable for students. For example, they might think of 20 minutes as the same (or almost the same) amount of time as recess or a particular TV show. Have a discussion with students about the passage of time, and use a timer or a clock to measure the passage of time for this activity.

Continue with other classroom activities. Use a timer or a clock to measure minutes. Every 20 minutes, have students examine the apple and potato slices. Point to the word *result* at the top of the second column of the chart on the activity sheet and explain that the term means what really happens in an experiment. Record students' observations of the results on the chart. At each 20-minute interval, have students record their observations in the appropriate column of their own chart.

Have students infer why the apple and potato slices wrapped in plastic wrap did not turn brown. Discuss the characteristics of the plastic wrap that make it useful for preventing the apple and potato thirds from turning brown quickly. Discuss other ways that plastic wrap is used at home (e.g., to wrap sandwiches and other foods for lunch; to wrap leftovers from dinner).

Compare the ability of the plastic wrap and the paper towel to keep the apple and potato slices from turning brown. Ask:

- Which materials worked best to keep the apple and potato from turning brown?
- Why do you think that is?
- How would you describe the plastic wrap?
- How would you describe the paper towel?
- Do you think their characteristics had anything to do with how well they keep the apple and potato from turning brown?

NOTE: Students do not need to provide a complex scientific explanation for why the wrapped apple and potato slices did or did not turn brown. They can simply say that when the apple and potato thirds are covered with plastic wrap, the slices will not turn brown quickly because the air cannot get at them. A characteristic of plastic wrap is that it does not let air through. However, the paper towel does have tiny holes in it (a characteristic) that let the air in, so it does not work quite as well to keep the apple and potato from turning brown.

Have students complete the chart on their activity sheet by drawing pictures to show what the apple and potato slices on each of the six plates look like after the hour has passed.

Explore: Part Two

Citizenship, Critical Thinking

Introduce students to traditional tools used by Indigenous Peoples in Manitoba. Project or display the images from the Image Bank: Tools Used by Indigenous Peoples. As each image is projected, have students:

- describe the characteristics of the object
- predict how the object is made and what materials are used
- infer where the materials come from
- predict what the tool is used for

As students share their ideas, provide them with relevant background information (included in the Appendix, on page 235). Discuss why certain materials are used in the construction of these tools.

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Take this opportunity to discuss the fact that all of these objects are made from materials found in nature.

NOTE: Consider visiting local museums that may have collections of similar items from Indigenous Peoples specific to your area.

Assessment as Learning AaL

Have students use the SCIENCE JOURNAL template, page 31, to reflect on what they learned during this lesson's investigation.

Makerspace

In addition to the materials available at the Makerspace, provide white glue and various natural materials (e.g., twigs, packing straw, grass).

Before students visit the Makerspace, read aloud the book *Home Is…* by Hannah Rodgers Barnaby, which describes homes created by humans and various other animals.

Discuss the different structures in the book. Ask:

- What structures do animals build? (e.g., spider webs, beaver dams, ant hills, bird nests)
- What materials do they use?

Next, discuss bird nests in particular. Ask:

- What is a bird's nest made from?
- Why do you think birds use these materials?
- How do you think birds make nests?

Read aloud the book *The Nest That Wren Built* by Randi Sonenshine, which is about the materials wrens gather to build their nests.

Challenge students to design and build bird nests using the materials at the Makerspace.

NOTE: Natural materials such as twigs and grass can be moulded together using mud or diluted white glue.

Embed

- Add to the KWHL chart as students learn new concepts, answer some of their own inquiry questions, and ask new inquiry questions.
- Add new terms, including *prediction* and *result*, and illustrations to the word wall. Include the words in languages other than English, as appropriate.
- Have students add new terms, examples, and pictures to their Pictionary (1.1.1). When possible, encourage them to add words and examples in languages other than English, including Indigenous languages, reflective of the classroom population.

Debrief

Revisit the guided inquiry question: **Why are some materials better than others for certain jobs?** Have students share their knowledge, provide examples, and ask further inquiry questions.

Enhance

- **Family Connection:** Provide students with the following sentence starter:
  - A _____ is made of _____ because _____.
  - For example: A chair is made of metal because metal is strong.

  Have students record the sentence starter in their science journal or agenda and complete it at home. Family members can help students draw and write about this topic. Have students share their completed sentences with the class.
- Conduct investigations to find out what other materials would stop the apple and potato slices from turning brown (e.g., glass containers, plastic bags, paper bags, aluminum foil, wax paper).

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- Encourage students to think of materials they could use that would be environmentally friendly. Also, encourage students to think of ways they could be more environmentally conscious about their own use of materials (e.g., reuse zipper-lock storage bags or aluminum foil, use glass food containers). Students may also suggest the use of lemon juice to prevent food from turning brown. Ask which method is more or most sustainable.
- To focus on creativity, give students everyday objects and ask them to come up with alternative uses for them. See the article "Creative Ideas for Common Objects" for examples at <https://playproject.org/creative-ideas-for-common-objects/>.



SAFETY NOTE: The following activity has students observing carpentry tools. Preface the activity by talking with students about safe handling of tools, and explain that they can cause injuries if not used carefully. Having an extra adult or two around during this activity is recommended.

- Invite a carpenter or contractor to the class to show students the tools they use for their jobs. Encourage students to ask questions about their careers, and also to identify the materials from which each tool is made.
- Invite a soapstone carver to demonstrate their craft for the class.

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1.4.1

Date: _____ Name: _____

Why Are Some Materials Better Than Others for Certain Jobs?

Before	After 20 minutes		After 40 minutes		After 1 hour	
	Prediction	Result	Prediction	Result	Prediction	Result
A						
B						
C						
D						
E						
F						

What happened during this experiment? _____

What did you learn? _____

1.4.1

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Appendix: Image Banks

Images in this appendix are thumbnails from the Image Banks referenced in the lessons.

Corresponding full-page, high-resolution images can be printed or projected for the related lessons. Download the digital resources for this book, including the image banks and reproducibles, using the instructions below. You may return to this link to download the desired files until a new edition is available for pre-order.

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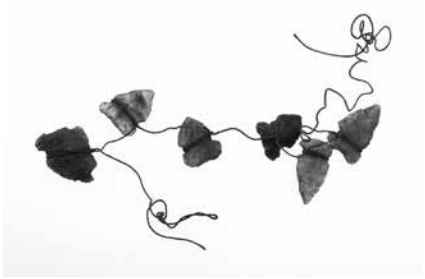
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Unit 1: Properties of Matter

Lesson 4: Why Are Some Materials Better Than Others for Certain Jobs?

Tools Used by Indigenous Peoples



1. Arrowheads – Northern Plains



2. Arrowpoint – Inuinnaq



3. Arrowpoint – Inuit



4. Tomahawk Head – Eastern Woodlands



5. Basket – Mi'kmaq



6. Basket – Abenaki or Penobscot



7. Basket – Iroquois



8. Pot – St. Lawrence Iroquois



9. Barbed Harpoon Head – Huron-Wendat



10. Mortar and Pestle – Iroquois or Mohawk



11. Ladle – Iroquois



12. Drinking Cup – Dakota

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13. Quiver – Niisitapiikwan or Anishinaabe



14. Bow – Assiniboine



15. Sling Shot – Eastern Cree or Innu



16. Snare – Eastern Cree or Innu



17. Netsinker – Eastern Cree or Innu



18. Knife – Anishinaabe

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Knowledge Keeper and writer **Richelle North Star Scott** (Giiwedinong Anong) says Aniin! I am of Anishinaabe and Métis descent, and my Ancestors are from St Peter's Reserve. I am the mother of three beautiful daughters: Amanda, Tehya, and Riel. I am a KooKoo of a fabulous grandson named Darius, but I call him Noozhis (which means grandchild). I am the Coordinator of Indigenous Inclusion Education for the St James-Assiniboia School Division. I am a Mide woman, Pipe Carrier, Water Carrier, and Sundancer. I have completed my mystery* in land-based education. (*I don't use "master's" as it is a gender-binary word.)

Greg Johnson, BSc in physics, BEd, is a classroom science teacher in Manitoba. He has taught in rural Manitoba, New Zealand, and in the St. James-Assiniboia School Division. He has been at Westwood Collegiate for 16 years as a teacher and department head. Specializing in physics, Greg teaches grades 11–12 Physics and IB Physics. He has also taught IB Chemistry, Science, and Mathematics. Greg has been a board member of the Science Teachers' Association of Manitoba since 2008, as member- at-large and vice president. He is interested in technology and maker education, which has led him to create a maker space and maker club at Westwood Collegiate. Greg has been a contributor to several departments of education initiatives and is currently part of the Literacy with Information and Communication Technology (LwICT) coding infusion team. Greg spends his spare time with his family and coaching hockey and baseball.

Jennifer E. Lawson, PhD, is the creator of the Hands-On books published by Portage & Main Press. As senior writer and editor for the series, she has contributed to more than 50 publications for teachers and students. Jennifer provides professional development workshops for educators locally, nationally, and virtually, and is a Workplace Wellness Advisor. Her most recent book is a collective effort called *Teacher, Take Care: A Guide to Well-Being and Workplace Wellness for Educators*. She is also one of the founders of Mission to Mexico, an organization that supports schools in some of the most impoverished communities in Puerto Vallarta. Throughout her extensive career in education, Jennifer has worked as a classroom teacher, resource and special education teacher, consultant, principal, university instructor, and school trustee. She lives with her family in Winnipeg, Manitoba.

For over 20 years, **Kellie Ierullo** (she, her, hers) has been an educator with the Toronto District School Board including as a classroom teacher, special education teacher, and now as a teacher-librarian, technology chair and science/STEM lead educator. Kellie is passionate about helping teachers engage students through meaningful coding and STEM activities and encouraging students to move beyond navigating technology to creating it for themselves. Kellie lives in Woodbridge, Ontario with her family.

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