British Columbia

hands-on science

An Inquiry Approach

Properties of Energy for Grades 3–5

Senior Author
Jennifer Lawson

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An Inquiry Approach

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Project Consultants:
Faye Brownlie
Kathleen Gregory

Science Consultant:
Rosalind Poon

Early Years Consultant:
Lisa Schwartz

Indigenous Consultant:
Desiree Marshall-Peer, Cree-Ojibway

Indigenous Contributor:
Melanie Nelson, Stó:lō and In-SHUCK-ch

Makerspace Contributors:
Joan Badger
Todd Johnson

Curriculum Correlation Consultant:
Susan Atcheson

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Introduction to *Hands-On Science*

About *Hands-On Science*

Hands-On Science helps develop students' scientific literacy through active inquiry, problem solving, and decision making. With each activity in ***Hands-On Science***, students are encouraged to explore, investigate, and ask questions as a means of heightening their own curiosity about the world around them. Students solve problems through firsthand experiences and by observing and examining objects within their environment. In order for students to develop scientific literacy, concrete experience is of utmost importance—in fact, it is essential.

Format of *Hands-On Science*

The redesigned Science Curriculum for British Columbia (<https://curriculum.gov.bc.ca/>) is based on a "**Know-Do-Understand**" model. The three elements—Content (Know), Curricular Competencies (Do), and Big Ideas (Understand) — all work together to support deeper learning. ***Hands-On Science*** promotes this model through its inquiry-based, student-centred approach. As such, it is structured around the following elements.

The **Big Ideas** are broad concepts introduced in kindergarten and expanded upon in subsequent grades, fostering a deep understanding of science. The Big Ideas form the basis of the ***Hands-On Science*** modules to address important concepts in biology, chemistry, physics, and earth/space science.

The **Core Competencies** are embedded throughout the curriculum and throughout ***Hands-On Science***. These competencies enable students to engage in deeper lifelong learning.

Core Competencies

Thinking	■ knowledge, skills, and processes that enable students to explore problems, weigh alternatives, and arrive at solutions ■ problem solving and making effective decisions, and applying them to real-world contexts
Communication	■ effectively reading, writing, speaking, listening, viewing, and representing ■ using a variety of information sources and digital tools
Personal and Social	■ relates to a student's identity as an individual and as a member of a group or community ■ contributing to the care of themselves, others, and the larger community

The **Learning Standards** are made up of **Curricular Competencies** and **Content**. **Curricular Competencies** are skills, strategies, and processes students develop as they explore science through hands-on activities. Curricular Competencies are addressed further on page 33.

The **Content** of the Science Curriculum for British Columbia and ***Hands-On Science*** is concept-based and relates directly to the Big Ideas. The Content relies on cross-cutting concepts developed throughout the grade levels, including:

- cause and effect
- change
- cycles
- evolution
- form and function
- interactions
- matter and energy
- order
- patterns
- systems

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The Multi-Age Approach

Hands-On Science is designed with a multi-age approach to meet the needs of students in grades three to five. Each module explores the Big Ideas, Core Competencies, and Learning Standards for grades three to five. This approach provides teachers and students with flexible, personalized learning opportunities.

Inquiry and Science

Throughout ***Hands-On Science***, as students explore science concepts, they are encouraged to ask questions to guide their own learning. The inquiry model is based on five components:

1. formulating questions
2. gathering and organizing information, evidence, or data
3. interpreting and analyzing information, evidence, or data
4. evaluating information, evidence, or data, and drawing conclusions
5. communicating findings

Using this model, teachers facilitate the learning, and students drive the process through inquiry. As such, the approach focuses on students' self-reflections as they ask questions, discover answers, and communicate their understanding. An inquiry approach begins with 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 given procedures and draw conclusions to answer the given 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.

Inquiry takes time to foster and requires scaffolding from a structured approach to more open inquiry as students gain skills and experience.

In ***Hands-On Science***, the focus of most activities is on guided inquiry, as teachers pose the main question for the lesson, based on the Learning Standards. Students are involved in generating further inquiry questions to personalize learning, but will continue to benefit from guidance and support from the teacher.

> Open inquiry activities are only successful if students are motivated by intrinsic interests and if they are equipped with the skills to conduct their own research study. (Banchi and Bell, 2008)

The Goals of Science Education in British Columbia

Science plays a fundamental role in the lives of Canadians. The Science Curriculum for British Columbia (<https://curriculum.gov.bc.ca/>) states:

> Science provides opportunities for us to better understand our natural world. Through science, we ask questions and seek answers to grow our collective scientific knowledge. We continually revise and refine our knowledge as we acquire new evidence. While maintaining our respect for evidence, we are aware that our scientific knowledge is provisional and is influenced by our culture, values, and ethics. Linking traditional and contemporary First Peoples understandings and current scientific knowledge enables us to make meaningful connections to our everyday lives and the world beyond.
>
> The Science curriculum takes a place-based approach to science learning. Students will develop place-based knowledge about the area in which they live, learning about and building on First Peoples knowledge and other traditional knowledge of the area. This provides a basis for an intuitive relationship with and respect for the natural world; connections to their ecosystem

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and community; and a sense of relatedness that encourages lifelong harmony with nature.

The Science Curriculum for British Columbia identifies five goals that form the foundation of science education. In keeping with this focus on scientific literacy, these goals are the bases for the lessons in ***Hands-On Science***. The Science Curriculum for British Columbia contributes to students' development as educated citizens through the achievement of the following goals. Students are expected to develop:

1. an understanding and appreciation of the nature of science as an evidence-based way of knowing the natural world that yields descriptions and explanations that are continually being improved within the context of our cultural values and ethics
2. place-based knowledge of the natural world and experience in the local area in which they live by accessing and building on existing understandings, including those of First Peoples
3. a solid foundation of conceptual and procedural knowledge in science that they can use to interpret the natural world and apply to new problems, issues, and events; to further learning; and to their lives
4. the habits of mind associated with science—a sustained curiosity; an appreciation for questions; an openness to new ideas and consideration of alternatives; an appreciation of evidence; an awareness of assumptions and a questioning of given information; a healthy, informed skepticism; a seeking of patterns, connections, and understanding; and a consideration of social, ethical, and environmental implications
5. a lifelong interest in science and the attitudes that will make them scientifically literate citizens who bring a scientific perspective, as appropriate, to social, moral, and ethical decisions and actions in their own lives, culture, and the environment

Hands-On Science Principles

- Effective science education involves hands-on inquiry, problem solving, and decision making.
- The development of Big Ideas, Core Competencies, Curricular Competencies, and Content form 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, worthwhile, and related to real-life experiences.
- The teacher's role is to facilitate activities and encourage critical thinking and reflection. Children learn best by doing, rather than by just listening. Instead of simply telling, the teacher, therefore, should focus on formulating and asking questions, setting the conditions for students to ask their own questions, and helping students to make sense of the events and phenomena they have experienced.
- Science should be taught in conjunction with other school subjects. Themes and topics of study should 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 knowledge and worldviews of Indigenous peoples, as well as other diverse multicultural perspectives.

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- Science education should emphasize personalized learning. Personalized learning focuses on enhancing student engagement and providing them with choices to explore and investigate ideas. Personalized learning also encompasses place-based learning, where learning focuses on the local environment.
- Science education is inclusive in nature. Learning opportunities should meet the diverse needs of all students through differentiated instruction and individualized learning experiences.
- Self-assessment is an integral part of science education. Students should be involved in reflecting on their work and setting new goals based on their reflections, which, in turn, enables them to take control of their learning.
- Teacher assessment of student learning in science should be designed to focus on performance and understanding, and should be conducted through meaningful assessment techniques implemented throughout each module.

Cultural Connections

To acknowledge and celebrate the cultural diversity represented in Canadian classrooms, it is important to infuse cultural connections into classroom learning experiences. It is essential for teachers to be aware of the cultural makeup of their class and to celebrate these diverse cultures by making connections to curricular outcomes. In the same way, it is important to explore other cultures represented in the community and beyond, to encourage intercultural understanding and harmony. For example, teachers in British Columbia should make connections to local cultural communities to highlight their contributions to the province. Throughout ***Hands-On Science***, suggestions are made for connecting science topics to cultural explorations and activities.

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Indigenous Perspectives and Knowledge

Indigenous peoples are central to the Canadian context, and it is important to infuse Indigenous knowledge into the learning experiences of all students. 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 call to "integrate Indigenous knowledge and teaching methods into classrooms" (Action 62) and "build student capacity for intercultural understanding, empathy and mutual respect" (Action 63).

Indigenous peoples have depended on the land since time immemorial. The environment shapes the way of life: geography, vegetation, climate, and natural resources of the land determine the methods used to survive. Since they observe the land and its inhabitants, the environment teaches Indigenous peoples to survive. The land continues to shape Indigenous peoples' way of life today because of their ongoing, deep connection with the land. Cultural practices, stories, languages, and knowledge originate from the land.

The traditional territories of the First Peoples cover the entirety of what is now British Columbia. The worldviews of Indigenous peoples and their approaches and contributions to science are now being acknowledged and incorporated into science education. It is also important to recognize the diversity of Indigenous peoples in British Columbia and to focus on both the traditions and contemporary lives of the Indigenous communities in your area. Contact personnel in your school district—Indigenous consultants and/or those responsible for Indigenous education—to find out what resources (e.g., people, books, videos) are available. Many such resources are also featured in ***Hands-On Science***.

NOTE: When implementing place-based learning, many opportunities abound to consider Indigenous perspectives and knowledge. Outdoor learning provides an excellent opportunity to identify the importance of place. For example, use a map of the local area to have students identify where the location is in relation to the school. This will help students develop a stronger image of their community and surrounding area.

It is also important to identify on whose traditional territory the school is located, the traditional territory of the location for the place-based learning, as well as the traditional names for both locations. The following map, "First Nations in British Columbia," from Indigenous Services Canada can be used for this purpose: <https://www.rcaanc-cirnac.gc.ca/DAM/DAM-ISC-SAC/DAM-STSCRD/STAGING/texte-text/map_room_ind_peoples_land_BC_FNcommunities_1615812992272_eng.pdf>.

Incorporate land acknowledgment once students have learned on whose territory the school and place-based learning location are located. The following example can be used for guidance:

- We would like to acknowledge that we are gathered today on the traditional, ancestral, and unceded territory of the _____ people, in the place traditionally known as _____.

When incorporating Indigenous perspectives, it is important to value Traditional Ecological Knowledge (TEK):

> 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 contemporary 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. (*Science First Peoples Teacher Resource Guide*)

Indigenous peoples developed technologies and survived on this land for millennia because of ▶

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their knowledge of the land. Indigenous peoples used observation and experimentation to refine technologies, such as building canoes and longhouses and discovering food-preservation techniques. As such, TEK serves as an invaluable resource for students and teachers of science.

Indigenous peoples do not view their knowledges as "science" but, rather, from a more holistic perspective, as is reflected in this quote from Dr. Jolly, Cherokee, President of the Science Museum of Minnesota:

> When I weave a basket, I talk about the different dyes and how you make them and how the Oklahoma clay that we put on our baskets doesn't permeate the cell walls, it deposits on the outside. It makes a very nice dye but if you cut through the reed you'll see white still on the inside of the reed, whereas if I make a walnut dye and if I use as my mordent alum and I use as my acid cider, that walnut dye will permeate the cell walls. You cut through the reed and it's brown through and through. Now what I've just described is the difference between osmosis and dialysis. That Western science calls those scientific terms is really wonderful, but it's not scientific terms if you are a basket weaver. Our culture incorporates so much of what people would call scientific knowledge and ways of thinking so naturally that we haven't parsed it out and put it in a book and said this is our science knowledge versus our weaver's knowledge. When I weave a basket I also tell the stories of the spirituality and not just the ways of which I dyed it. A basket weaver is as much a scientist, as an artist, and a spiritual teacher. We'd never think that you'd separate out just the science part, but you can't weave a basket without knowing the science. (quoted in Mack et al., 2012, pp. 50–51)

Throughout ***Hands-On Science***, there are many opportunities to incorporate culturally appropriate teaching methodologies from an Indigenous worldview. First Peoples Pedagogy indicates that making connections to the local community is central to learning (*Science First Peoples Teacher Resource Guide*). As one example, Elders and Knowledge Keepers offer a wealth of knowledge that can be shared with students. Consider inviting a local Elder or Knowledge Keeper as a guest into the classroom in connection with specific topics being studied (as identified within the given lessons throughout the module). An Elder or Knowledge Keeper can guide a nature walk, share stories and experiences, share 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 community.

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 Elder Definition" at <https://www.ictinc.ca/blog/indigenous-elder-definition>).
- Some Indigenous keepers of knowledge are more comfortable being called "Knowledge Keepers" than "Elders." Be sensitive to their preference. In many communities, there are also "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. It is important to respect this choice and not be directive about what an Elder or Knowledge Keeper will talk about during their visit.

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- It is important to properly acknowledge any visiting Elders or Knowledge Keepers and their knowledge, as they have traditionally been and are recognized within Indigenous communities as highly esteemed individuals. There are certain protocols that should be followed when inviting an Elder or Knowledge Keeper to support student learning in the classroom or on the land. The *Science First Peoples Teacher Resource Guide* offers guidelines and considerations for this.

  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 British Columbia. Consider contacting Indigenous education consultants within your local school district or with the British Columbia Ministry of Education to access referrals. The following link provides a province-wide list of Indigenous contacts: https://curriculum.gov.bc.ca/curriculum/indigenous-education-resources. 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 place-based learning.

NOTE: It is important for educators to understand the significant contribution that Elders, Knowledge Keepers, and Indigenous communities make 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. As such, educators should think deeply about reciprocity and what they can do beyond inviting Indigenous guests to their classrooms. Educators can expand their own learning and become connected to Indigenous people by, for example, engaging in Indigenous community events, working with the Education Department of the local Nations, or exploring ways to continue developing the relationship between the local Nations and educators in the district.

The First Nations Education Steering Committee of British Columbia has articulated the following **First Peoples Principles of Learning**:

- Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.
- Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
- Learning involves recognizing the consequences of one's actions.
- Learning involves generational roles and responsibilities.
- Learning recognizes the role of Indigenous knowledge.
- Learning is embedded in memory, history, and story.
- Learning involves patience and time.
- Learning requires exploration of one's identity.
- Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.

These principles generally reflect First Peoples pedagogy, and have been considered in the development of ***Hands-On Science***.

> The First Peoples Principles of Learning (FPPL) is a framework for approaching learning, or a worldview on what learning is and how it happens. Teachers are encouraged to find their own meaning in them, explore them with their class, and take them up in a way that is meaningful to them. They are embedded in the new curriculum—the new curriculum was created based on these principles. Teachers can make their own connections to the FPPL through the ***Hands-On Science*** resource. (Melanie Nelson, February 12, 2018)

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It is also important to note that the *Science First Peoples Teacher Resource Guide* recommends a 7E model for guiding experiential learning activities in science. This model suggests that the following elements are essential to the learning experience:

The 7E Model

Environment	■ using the local land (place-based learning)
Engage	■ inspiring curiosity and activating knowledge
Explore	■ investigating science concepts through hands-on experiences
Elders	■ connecting local Knowledge Keepers to learning
Explain	■ describing observations and sharing new knowledge
Elaborate	■ extending and enhancing learning
Evaluation	■ providing opportunities for students to demonstrate understanding and skills

These seven elements are strongly evident in the approach used in ***Hands-On Science***, as is explained in the following sections.

For more information on First Peoples Pedagogy and First Peoples Principles of Learning, please see the *Science First Peoples Teacher Resource Guide*.

NOTE: Indigenous resources recommended in *Hands-On Science* are considered to be authentic resources, meaning that they reference the Indigenous community they came from, they state the individual who shared the story and gave permission for the story to be used publicly, and the person who originally shared the story is Indigenous. Stories that are works of fiction were written by an Indigenous author. For more information, please see *Authentic First Peoples Resources* at: <www.fnesc.ca/authenticresources/>.

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

Hands-On Science is organized in a format that makes it easy for teachers to plan and implement. Four modules address the selected topics of study for grade-three to grade-five classrooms. The modules relate directly to the Big Ideas, Core Competencies, Curricular Competencies, and Content outlined in the Science Curriculum for British Columbia.

Multi-Age Teaching and Learning

Whether working with students in a single-grade classroom from grades three to five, or working with multi-age classes, teachers will find appropriate learning opportunities in ***Hands-On Science***. The lessons meet the diverse needs of all students through the implementation of differentiated instruction and personalized learning.

The Science Curriculum for British Columbia establishes specific Big Ideas, Curricular Competencies, and Content for each grade level. ***Hands-On Science*** has worked within themes to infuse these Big Ideas, Curricular Competencies, and Content into multi-age modules (see the Curriculum Learning Framework at the beginning of each module). It is therefore important for teachers to work collaboratively with their colleagues across grade levels to determine how best to implement lessons. The Curriculum Learning Frameworks will also be helpful, as each one includes a grade-level focus for specific lessons. This will assist teachers in both single-grade classrooms or multi-age classrooms to identify lessons and topics appropriate to their class.

Differentiated instruction and personalized learning will also ensure the needs of all students are met during science lessons. For example, in any classroom, whether multi-age or single-grade, students will be working at varying levels of literacy. As such, some students may be communicating their learning at early literacy stages, through drawings and simple text, while others write several sentences and construct detailed labelled diagrams. The lessons in ***Hands-On Science*** are developed to foster growth and learning at all literacy levels.

The same situation may be evident in terms of numeracy. For example, some students may be using early numeracy skills to estimate and measure, while other students may be capable of working with a variety of measuring devices, using more complex numeracy skills. There is plenty of flexibility in ***Hands-On Science*** to ensure that all students' learning needs can be met through active, student-centred learning.

Module Overview

Each module features an overarching question that fosters inquiry related to the Big Ideas. The module also has its own introduction, which summarizes the general concepts and goals for the module. This introduction provides background information for teachers, planning tips, and lists of vocabulary related to the module, as well as other pertinent information (e.g., how to embed Indigenous perspectives).

Also included at the beginning of each module is a Curriculum Learning Framework, which is based on the Big Ideas and Learning Standards (Curricular Competencies and Content) from the Science Curriculum for British Columbia (https://curriculum.gov.bc.ca/).

The Curriculum Learning Framework identifies the Big Ideas, Sample Guided Inquiry Questions, and Content for each grade level. As well, Content is connected to specific lessons, which are listed with each Content concept. Although specific lessons were intentionally written for grade-level content, much of this content is interconnected. As such, the overarching theme of the module provides a variety of connections to all three grade levels and, therefore, offers many springboards to learning.

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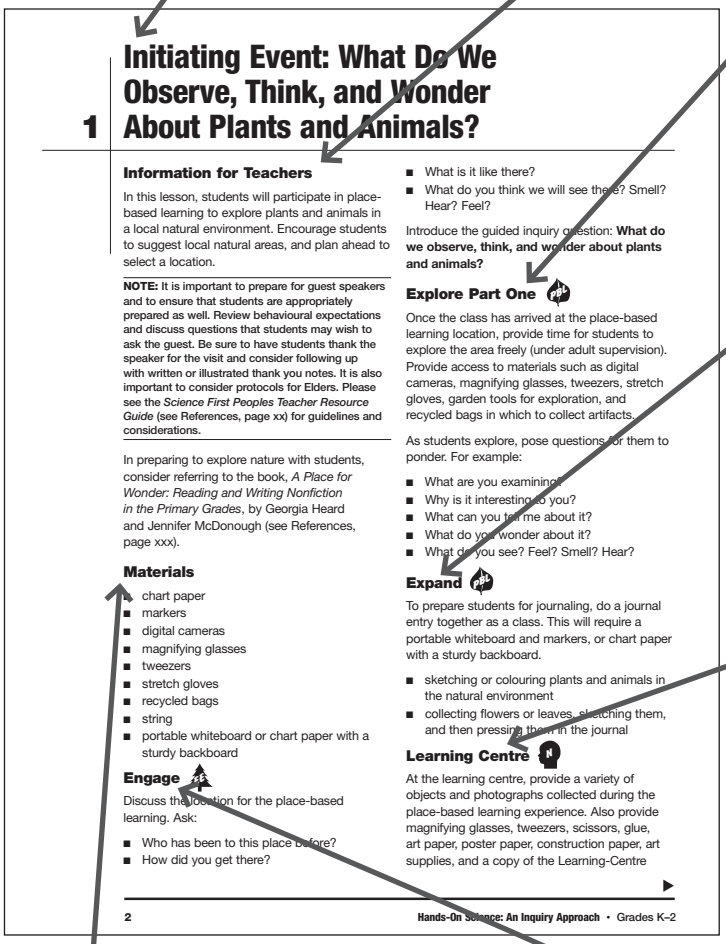
Lesson Title
- provides a guided inquiry question related to the Learning Standards explored in the lesson

Information for Teachers
- presents basic scientific knowledge needed for activities



1 Initiating Event: What Do We Observe, Think, and Wonder About Plants and Animals?

Information for Teachers

In this lesson, students will participate in place-based learning to explore plants and animals in a local natural environment. Encourage students to suggest local natural areas, and plan ahead to select a location.

NOTE: It is important to prepare for guest speakers and to ensure that students are appropriately prepared as well. Review behavioural expectations and discuss questions that students may wish to ask the guest. Be sure to have students thank the speaker for the visit and consider following up with written or illustrated thank you notes. It is also important to consider protocols for Elders. Please see the *Science First Peoples Teacher Resource Guide* (see References, page xx) for guidelines and considerations.

In preparing to explore nature with students, consider referring to the book, *A Place for Wonder: Reading and Writing Nonfiction in the Primary Grades*, by Georgia Heard and Jennifer McDonough (see References, page xxx).

Materials
- chart paper
- markers
- digital cameras
- magnifying glasses
- tweezers
- stretch gloves
- recycled bags
- string
- portable whiteboard or chart paper with a sturdy backboard

Engage

Discuss the location for the place-based learning. Ask:
- Who has been to this place before?
- How did you get there?
- What is it like there?
- What do you think we will see there? Smell? Hear? Feel?

Introduce the guided inquiry question: **What do we observe, think, and wonder about plants and animals?**

Explore Part One

Once the class has arrived at the place-based learning location, provide time for students to explore the area freely (under adult supervision). Provide access to materials such as digital cameras, magnifying glasses, tweezers, stretch gloves, garden tools for exploration, and recycled bags in which to collect artifacts.

As students explore, pose questions for them to ponder. For example:
- What are you examining?
- Why is it interesting to you?
- What can you tell me about it?
- What do you wonder about it?
- What do you see? Feel? Smell? Hear?

Expand

To prepare students for journaling, do a journal entry together as a class. This will require a portable whiteboard and markers, or chart paper with a sturdy backboard.
- sketching or colouring plants and animals in the natural environment
- collecting flowers or leaves, sketching them, and then pressing them in the journal

Learning Centre

At the learning centre, provide a variety of objects and photographs collected during the place-based learning experience. Also provide magnifying glasses, tweezers, scissors, glue, art paper, poster paper, construction paper, art supplies, and a copy of the Learning-Centre

Explore
- presents whole-class and small-group activities that provide students with choice and opportunities to pose further inquiry questions while collaborating with peers
- details procedures, including higher-level questioning techniques, and suggestions for encouraging the development of concepts and skills
- identified as Explore Part One, Explore Part Two, and so on (when there is more than one in a lesson)

Expand
- provides opportunities for individual students to expand what they know, do, and understand
- empowers and encourages students to pose their own inquiry questions and conduct investigations, research, and projects individually, with support and facilitation by the teacher as needed; student success will depend on prior modelling, guided practice, and individual skills
- includes suggestions for Makerspace projects

Learning Centre
- supports diverse learners, promotes differentiated instruction, and is based on multiple-intelligences research (see page 17)
- includes a task card that remains at the centre, along with any required supplies and materials; review the task card before students work at the centre to ensure they are familiar with the content and the expectations (students are not expected to read and comprehend all content on the card, but it serves as a guide for teachers and a visual prompt for students)

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 encourage discussion
- connects to Image Bank visuals, which may be printed or projected for specific activities (see Appendix on page 163 for thumbnails and free access)

Engage
- activates prior knowledge, piques students' curiosity about related concepts, and introduces the lesson's guided inquiry question
- models for students how to pose their own inquiry questions; teachers may choose to record the guided inquiry question (e.g., on a sentence strip) for display, so students can refer to it during activities and discussions

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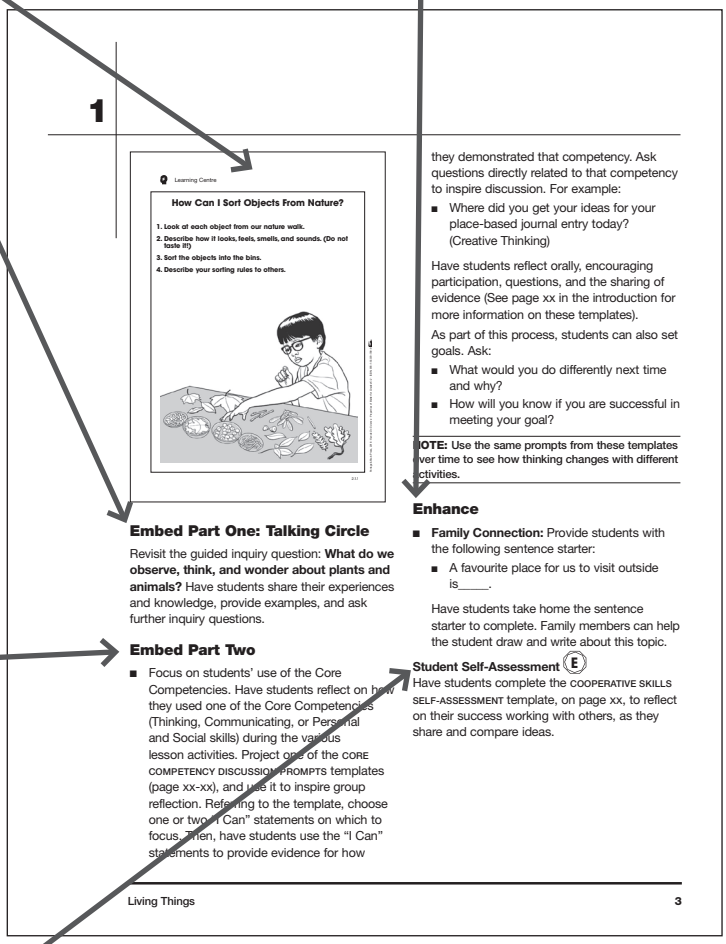
Reproducibles
- may be used to guide activities or record data
- may also serve as a template for designing and constructing graphic organizers
- included as thumbnails in the lessons
- provided as full-sized, printable version on the Portage & Main website (see Appendix for URL and password)

Enhance
- enriches and elaborates on the Big Idea, Core Competencies, and Learning Standards with optional activities
- encourages active participation and learning through Family Connections

Embed Part One
- provides students with opportunities to participate in a Talking Circle (see page 16) to demonstrate their learning through consolidation and reflection
- allows for synthesis and application of inquiry and new ideas
- reviews main ideas of the lesson, focusing on the Big Idea, Core Competencies, and Learning Standards
- reviews guided inquiry question so students can share their knowledge, provide examples, and ask further inquiry questions

Embed Part Two
- embeds learning by adding to graphic organizers; having students record, describe, and illustrate new vocabulary; and adding new vocabulary to the word wall throughout the module or even all year
- provides opportunity to reflect the cultural diversity of the classroom and the community by including new terminology in languages other than English, including Indigenous languages
- explores Core Competencies with students to foster student self-assessment of how these skills were used throughout the lesson

Assessment
- provides suggestions for authentic assessment
- includes student self-assessment, formative assessment, and summative assessment (see pages 29–34)



1

Learning Centre

How Can I Sort Objects From Nature?

1. Look at each object from our nature walk.
2. Describe how it looks, feels, smells, and sounds. (Do not taste it!)
3. Sort the objects into the bins.
4. Describe your sorting rules to others.

Embed Part One: Talking Circle

Revisit the guided inquiry question: **What do we observe, think, and wonder about plants and animals?** Have students share their experiences and knowledge, provide examples, and ask further inquiry questions.

Embed Part Two

- Focus on students' use of the Core Competencies. Have students reflect on how they used one of the Core Competencies (Thinking, Communicating, or Personal and Social skills) during the various lesson activities. Project one of the CORE COMPETENCY DISCUSSION PROMPTS templates (page xx-xx), and use it to inspire group reflection. Referring to the template, choose one or two "I Can" statements on which to focus. Then, have students use the "I Can" statements to provide evidence for how they demonstrated that competency. Ask questions directly related to that competency to inspire discussion. For example:
  - Where did you get your ideas for your place-based journal entry today? (Creative Thinking)

Have students reflect orally, encouraging participation, questions, and the sharing of evidence (See page xx in the introduction for more information on these templates).

As part of this process, students can also set goals. Ask:
- What would you do differently next time and why?
- How will you know if you are successful in meeting your goal?

NOTE: Use the same prompts from these templates over time to see how thinking changes with different activities.

Enhance

- **Family Connection:** Provide students with the following sentence starter:
  - A favourite place for us to visit outside is_____.

Have students take home the sentence starter to complete. Family members can help the student draw and write about this topic.

Student Self-Assessment (E)
Have students complete the COOPERATIVE SKILLS SELF-ASSESSMENT template, on page xx, to reflect on their success working with others, as they share and compare ideas.

Living Things 3

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The Curricular Competencies Correlation Chart at the beginning of each module provides details on how students' Curricular Competencies are developed through scientific inquiry. The chart outlines the skills, strategies, and processes that students use in the module and identifies the specific lessons in which these Curricular Competencies are the focus. The Curricular Competencies are developed in various ways over time, and therefore are addressed in multiple lessons throughout ***Hands-On Science*** modules.

Each module includes a list of related resources for students (books, websites, and online videos).

Each module is organized into lessons based on the Learning Standards. The first lesson in each module provides an initiating event, using an Observe-Think-Wonder strategy. Real-life explorations, often within the local environment, provide opportunity for place-based learning, which is discussed in more detail on page 18.

The second lesson in each module explores storytelling as it relates to the inquiry topics. This lesson includes an emphasis on Indigenous stories, children's literature, and nonfiction texts, while providing opportunities for students to engage in activities that focus on literacy and creative storytelling.

The last lesson in each module provides an opportunity for personalized learning through individualized inquiry, as students explore what more they would like to *know*, *do*, and *understand* about the module's Big Ideas.

Talking Circles

Each lesson encourages the class to participate in a Talking Circle to consolidate learning and debrief on guided inquiry questions. Talking Circles originated with First Nations leaders as a process to encourage dialogue, respect, and the co-construction of ideas. The following process is generally used in a Talking Circle:

- the group forms a complete circle
- one person holds an object such as a stick, feather, shell, or stone
- only the person holding the stick talks, while the rest listen
- the stick is passed around in a clockwise direction
- each person talks until they are finished, being respectful of time
- the Talking Circle is complete when everyone has had a chance to speak
- a person may pass the stick without speaking, if they choose

See <www.firstnationspedagogy.ca/circletalks.html> for more information. Also consider inviting a local Elder or Knowledge Keeper to share with the class the process of a Talking Circle.

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Multiple Intelligences Learning Centres

Learning centres in ***Hands-On Science*** focus on different multiple intelligences to provide opportunities for students to use areas of strength and also to expose them to new ways of learning.

Teachers are encouraged to explore the topic of multiple intelligences with their students and to have students self-reflect to identify ways they learn best, and ways that are challenging for them. Guidelines for this process are included in *Teaching to Diversity* by Jennifer Katz (see References, page 20).

Multiple Intelligence	These learners…
Verbal-Linguistic	…think in words and enjoy reading, writing, word puzzles, and oral storytelling.
Logical-Mathematical	…think by reasoning and enjoy problem solving, puzzles, and working with data.
Visual-Spatial	...think in visual pictures and enjoy drawing and creating visual designs.
Bodily-Kinesthetic	…think by using their physical bodies and enjoy movement, sports, dance, and hands-on activities.
Musical-Rhythmic	…think in melodies and rhythms and enjoy singing, listening to music, and creating music.
Interpersonal	…think by talking to others about their ideas and enjoy group work, planning social events, and taking a leadership role with friends or classmates.
Intrapersonal	…think within themselves and enjoy quietly thinking, reflecting, and working individually.
Naturalistic	…learn by classifying objects and events and enjoy anything to do with nature and scientific exploration of natural phenomena.
Existential	…learn by probing deep philosophical questions and enjoy examining the bigger picture as to why ideas are important.

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Icons

To provide a clear indication of important features of ***Hands-On Science***, the following icons are used throughout lessons:

Place-Based Learning	Place-based learning focuses on the local environment and community. It is important for students to explore the local area in order to build personalized and contextual knowledge. Place-based learning: ■ emphasizes exploring the natural environment, replacing classroom walls with the natural land ■ offers firsthand opportunities to observe, explore, and investigate the land, waters, organisms, and atmosphere of the local region ■ promotes a healthy interplay between society and nature ■ helps students envision a world where there is meaningful appreciation and respect for our natural environment—an environment that sustains all life Many lessons in ***Hands-On Science*** incorporate place-based learning activities, whether it be a casual walk around the neighbourhood to examine trees or a more involved exploration of local waterways.
Applied Design, Skills, and Technologies	Throughout ***Hands-On Science***, students have opportunities to use applied design, skills, and technologies to plan and construct objects. For example, in *Properties of Energy for Grades 3–5*, students design and construct a bowl made of natural materials for heating liquids. Using applied design skills and technology, students seek solutions to practical problems through research and experimentation. There are specific steps: 1. Identify a need. Recognize practical problems and the need to solve them. 2. Create a plan. Seek alternate solutions to a given problem, create a plan based on a chosen solution, and record the plan through writing and labelled diagrams. 3. Develop a product or prototype. Construct an object that solves the given problem, and use predetermined criteria to test the product. 4. Communicate the results. Identify and make improvements to the product, and explain the changes.
Ecology and the Environment	***Hands-On Science*** provides numerous opportunities for students to investigate issues related to ecology, the environment, and sustainable development. The meaning of sustainability can be clarified by asking students: "Is there enough for everyone, forever?" These topics also connect to Indigenous worldviews about respecting and caring for the Earth.
Technology	Digital learning, or information and communication technology (ICT), is an important component of any classroom. As such, technological supports available in schools—digital cameras, computers/tablets, interactive whiteboards (IWB), projectors, document cameras, audio-recording devices, calculators—can be used with and by students to enhance their learning experiences.
Classroom Safety	When there are safety concerns, teachers may decide to demonstrate an activity, while still encouraging as much student interaction as possible. The nature of science and scientific experimentation means that safety concerns do arise from time to time.

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Makerspaces

To foster open inquiry and promote personalized learning, each module of ***Hands-On Science*** suggests a Makerspace as part of the Expand section. A Makerspace is a creative do-it-yourself environment, where participants pose questions, share ideas, and explore hands-on projects. In the school setting, a Makerspace is usually cross-curricular and should allow for inquiry, discovery, and innovation. Sometimes, the Makerspace is housed in a common area, such as the library, which means it is a space used by the whole school community. A classroom Makerspace is usually designed as a centre where students create do-it-yourself projects, emphasizing personalized learning, while collaborating with others on cross-curricular ideas. It is important to remember learning is not directed here. Rather, simply create conditions for learning to happen.

There is no list of required equipment that defines a Makerspace; however, the centre may evolve to foster inquiry within a specific topic. Students are given the opportunity to work with a variety of age-appropriate tools, as well as with everyday, arts-and-crafts, and recycled materials. Materials to consider at Makerspaces include:

- general supplies (e.g., graph or grid paper for planning and designing, pencils, markers, paper, cardstock, cardboard, scissors, masking tape, duct tape, glue, rulers, metre sticks, tape measures, elastic bands, string, Plasticine, modelling clay, fabric/cloth, straws, pipe cleaners, aluminum foil)
- recycled materials (e.g., various sizes of boxes, cardboard rolls, milk cartons, plastic bottles, spools, plastic lids)
- art supplies (e.g., paper, paint, markers, chalk, pastels, crayons, pencil crayons, beads, sequins, foam shapes, yarn, glass beads)
- building materials (e.g., sticks, wooden blocks, wooden dowels, toothpicks, craft sticks, balsa wood)
- age-appropriate tools (e.g., hammers, nails, screwdrivers, screws)
- natural objects (e.g., rocks, shells, feathers, seeds, wood slices, sticks)
- commercial products (e.g., LEGO, LEGO Story Starter, WeDo, MakeDo, Meccano, Plus-Plus, K'Nex, KEVA Planks, Dominoes, Wedgits)
- technology (e.g., Green Screen, iPads, coding/programming resources [Beebots, Code-a Pillar], apps such as Hopscotch, Tynker, Scratch Jr., Tickle)
- topic-based literature to inspire projects
- reference materials (e.g., books, videos, websites, visual images)

Work with students to develop a collaborative culture in which they tinker, invent, and improve on their creations. Ask students for ideas on how to stock the Makerspace, based on their project ideas, and then work collaboratively to acquire these supplies. The internet may also provide ideas for projects and materials.

Set up a recycling box/bin at the Makerspace for paper, cardboard, clean plastics, and other materials students can use for their creations. Stress to students that Makerspaces can help reuse many items destined for a landfill. Discuss which items can/should be placed in this bin.

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. Engage students in a discussion about safety and respect at the Makerspace before beginning each module. Consider sharp objects, small parts, and other potential hazards for students of

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all ages and abilities who will have access to the Makerspace. At this age, this exploration needs to be supervised.

- Consider space and storage needs. Mobile carts and/or bins are handy for storing raw materials and tools.
- Work with students to write a letter to parents/guardians, explaining the purpose of the Makerspace, and asking for donations of materials.

In ***Hands-On Science***, each module includes a variety of suggestions for Makerspace materials, equipment, possible challenges, and literature links related to the Big Ideas being explored.

The Makerspace process is intended for solving design problems, so it is helpful to have visuals at the Makerspace to encourage innovation, creativity, and the use of Applied Design, Skills, and Technologies (see page 18). In addition, although individual inquiry is encouraged, the Makerspace process is often collaborative in nature. Therefore, it is important to focus on skills related to working with others (see the Cooperative Skills Assessment templates on pages 49 and 52).

Before students begin working at a Makerspace, review Applied Design, Skills, and Technologies and collaborative skills with students. As a class, co-construct criteria for each skill, record it on chart paper, and display it at the Makerspace. Or, challenge students to create posters for the Makerspace that convey what Applied Design, Skills, and Technologies and collaboration look like. Refer to these visual prompts before, during, and after students work at the centre, as a means of guiding and assessing the process.

As students create, photograph their creations to share with the class, and discuss the unique properties of their designs. Model appropriate digital citizenship with students by asking their permission to photograph and share their creations. Facilitate regular debriefing sessions as a class, after students have spent time at the Makerspace. Consider focusing this discussion on the Core Competencies (Thinking, Communication, and Personal and Social Skills) as an anchor for reflective practice.

The nature of a Makerspace is such that it provides an excellent venue for personalized learning. As students pose their own inquiry questions, they may choose to use the Makerspace to explore those questions further.

References

British Columbia Ministry of Education. *BC's Course Curriculum.* 2016. <https://curriculum.gov.bc.ca/>

Katz, Jennifer. *Teaching to Diversity*. Winnipeg, MB: Portage & Main Press, 2012.

"Talking Circles." *First Nations Pedagogy Online.* <www.firstnationspedagogy.ca/circletalks.html>

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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 current research about the value of quality classroom assessment (Davies, 2011), suggestions are provided for authentic assessment, which includes student self-assessment and reporting of Core Competencies.

British Columbia's K–12 Assessment System (see https://curriculum.gov.bc.ca/classroom-assessment) states:

> Assessment and curriculum are interconnected. Curriculum sets the learning standards that give focus to classroom instruction and assessment. Assessment involves the wide variety of methods or tools that educators use to identify student learning needs, measure competency acquisition, and evaluate students' progress toward meeting provincial learning standards.
>
> [British Columbia's] assessment system is being redesigned to align with the new curriculum. Assessment of all forms will support a more flexible, personalized approach to learning and measure deeper, complex thinking. [British Columbia's] educational assessment system strives to support student learning by providing timely, meaningful information on student learning through multiple forms of assessment. The assessment system has three programs:
>
> 1. Classroom Assessment and Reporting
> 2. Provincial Assessment
> 3. National and International Assessment
>
> Classroom assessment is an integral part of the instructional process and can serve as a meaningful source of information about student learning. Feedback from ongoing assessment in the classroom can be immediate and personal for a learner and guide the learner to understand their [strengths and challenges] and use the information to set new learning goals.

The primary purpose of assessment is to improve student learning. ***Hands-On Science*** provides assessment suggestions, rubrics, and templates for use during the teaching/learning process. These assessment suggestions include tasks related to *student self-assessment* of the Core Competencies, as well as *formative assessment* and *summative assessment* by the teacher.

Student self-assessment helps students develop their capacity to set their own goals, monitor their own progress, determine their next steps in learning, and reflect on their learning in relation to the three Core Competencies—Thinking, Communication, and Social and Personal.

Formative assessment requires that teachers provide students with descriptive feedback and coaching for improvement in relation to the Learning Standards (Curricular Competencies and Content).

Summative Assessment is comprehensive in nature, and is intended to identify student progress in relation to the Learning Standards (Curricular Competencies and Content).

Both summative and formative assessments are an integral part of a balanced classroom assessment plan. Then, when student self-assessment is infused into this assessment plan, a clearer picture emerges of where a student is in relation to the Core Competencies and Learning Standards.

Student Self-Assessment

It is important for students to reflect on their own learning. For this purpose, a variety of assessment templates are provided in ***Hands-On Science***. Depending on their literacy levels, students may complete self-assessments in various ways. For example, the templates may be used as guides for oral conferences between teacher and student, or an adult may act as a

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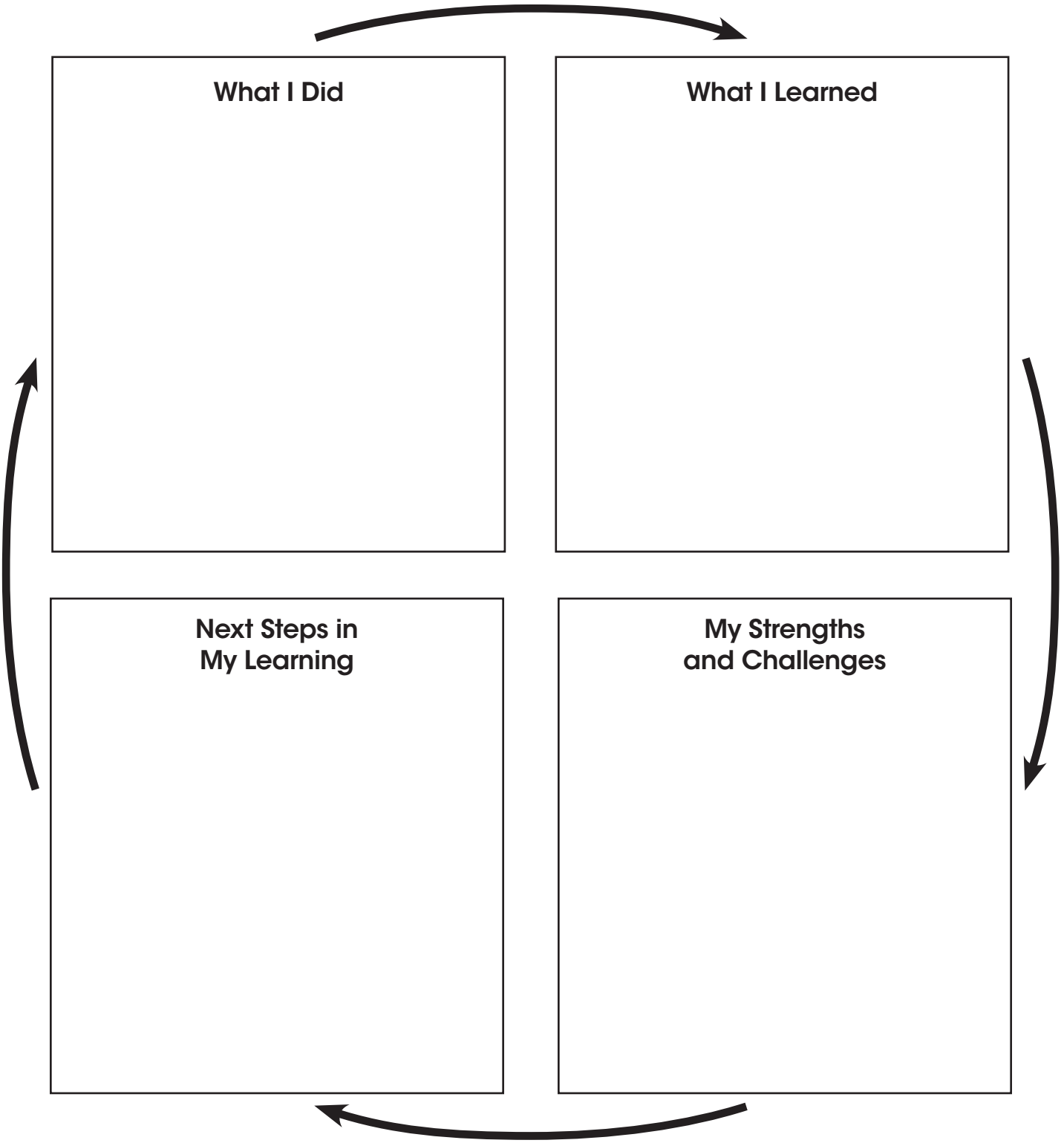
Date: _____ **Name:** _____

Student Reflections



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Date: _____ **Name:** _____

Core Competency Self-Reflection Frame
Communication

I Can...	Examples	Next Steps
I can answer questions.		
I can listen to others when they speak.		
I can share my learning.		
I can work in a group.		

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Date: _____ **Name:** _____

Family and Community Connections: Assessing Together

Family/Community Member's Name: _____

Work together to draw a labelled picture that shows what you have been learning in science. Then, describe your learning in sentences.

_____

_____

_____

What do you like best about what you have been learning in science?

_____

_____

_____

What does your family/community member like best about what you have been learning in science?

_____

_____

_____

_____

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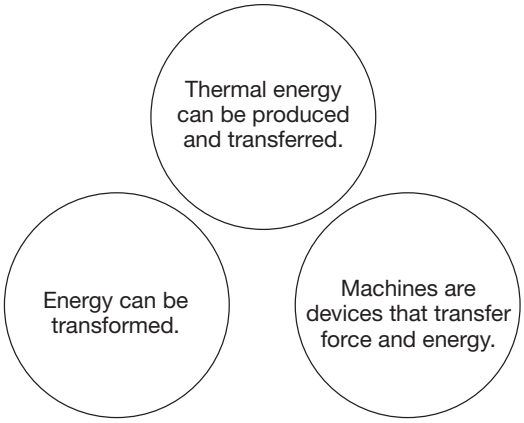
What Are the Properties of Energy?

About This Module

This module of ***Hands-On Science*** focuses on the properties of energy. Students will conduct investigations that explore the following Big Ideas:



While investigating these Big Ideas, the Curricular Competencies will be addressed as students use the following skills, strategies, and processes:

QP	questioning and predicting
PC	planning and conducting investigations
PA	processing and analyzing data and information
AI	applying and innovating
C	communicating
E	evaluating

In this module, students will explore thermal energy (heat energy), energy transformation, and simple machines.

Energy is the ability to do work. Something has energy if it is either moving or has the potential to move. Some of its forms are kinetic energy (energy of motion), light energy, sound energy, thermal energy (heat energy), elastic energy, nuclear energy, chemical energy, magnetic energy, gravitational energy, electrical energy, muscular energy, and radiation energy.

The two main forms of energy are *kinetic energy* and *potential energy*. These energies are found in all objects. If an object is in motion, it has *kinetic energy*. Energy stored within an object is known as *potential energy*. (Chemical energy and gravitational energy are potential energies.)

The Sun is the ultimate source of all energy for our planet. It provides several forms of energy, including light, thermal (heat), and radiation. All living things rely on the Sun's energy for survival.

NOTE: See the module *Living Things for Grades 3–5* for lessons related to how living things use energy from the Sun.

Until about 300 years ago, humans had few sources of energy. They relied on chemical energy from food, muscular energy from human and animal labour, thermal (heat) and light energy from fire (e.g., wood, candles, torches), and kinetic energy from wind (e.g., ships' sails, windmills) and water (e.g., water mills).

During the Industrial Revolution, new technologies allowed access to chemical energy from fossil fuels (e.g., coal, oil, natural gas). When demands for energy exceeded known energy supplies, other energy sources were developed. Today, two important sources of energy are hydroelectric power and nuclear power.

A *machine* is any device that makes objects move or stops objects from moving. Machines make work easier by changing the speed, amount, or direction of a force. The work becomes easier because it requires less energy.

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All machines, no matter how complex, are made up of one or more *simple machines*. The six simple machines are the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw. Gears are wheel-and-axle mechanisms with teeth that fit together to change the direction or speed of movement.

Incorporate Indigenous perspectives and worldviews into lessons whenever possible. This module provides many opportunities for students to learn about the ways Indigenous peoples view the world around them.

Many Indigenous peoples believe that energy flows throughout every object in the universe, and that energy needs to be kept in balance and harmony. We, as humans, are part of that balance and harmony. We should not over-consume resources, and we need to be respectful when we harvest resources. We also need to monitor our own harmony and balance in the physical, mental, emotional, and spiritual realms.

Indigenous peoples understand how different types of energy interact with the natural world and apply this knowledge to many aspects of daily life and survival (e.g., using thermal [heat] energy from the sun or a fire to cure hides, cooking with the thermal [heat] energy of a fire, hunting and finding food based on seasonal changes, using kinetic energy for manual tasks such as carving or paddling a canoe).

Energy transformation is infused into Indigenous perspectives as part of daily life, such as thermal energy and light energy from fire or muscular energy being transformed to kinetic energy when paddling a canoe.

Indigenous peoples use knowledge of energy, forces, and simple machines to create utensils and tools that make work more efficient; in fact, many of these tools are important for survival. Spears, axes, and hunting knives, originally made with blades of bone or stone, were eventually made with metal. Oral stories tell of knives and other tools made from obsidian (a shiny volcanic glass). As well, a knife called a *flesher* (a wedge) is used to remove flesh from animal skins; sharp carving tools (wedges) are made from stone and bone; hammers (levers) were developed from stone; drumsticks (levers) are made from wood; and pulleys may have been used by some Indigenous peoples to set broken bones and dislocated joints.

Place-Based Learning

Implementing place-based learning offers many opportunities to consider Indigenous perspectives and knowledge. Outdoor learning provides an excellent opportunity to identify the importance of place. Use a map of the local area to have students identify where the place-based learning location is in relation to the school. This will help students develop a stronger image of their community and the surrounding area.

Identify on whose traditional territory the school is located, the traditional territory of the location for the place-based learning, and the traditional names for both. Use the following map for this purpose: "First Nations in British Columbia," from Indigenous Services Canada at <https://www.rcaanc-cirnac.gc.ca/DAM/DAM-ISC-SAC/DAM-STSCRD/STAGING/texte-text/map_room_ind_peoples_land_BC_FNcommunities_1615812992272_eng.pdf>.

Incorporate a land acknowledgment when students have learned on whose territory the school and place-based learning location are located. The following example can be used for guidance:

- We would like to acknowledge that we are gathered today on the traditional, ancestral, and unceded territory of the _____ people, in the place traditionally known as _____.

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NOTE: Many school districts have established protocols for land acknowledgment. Check with colleagues who support Indigenous education to see if there are specific protocols to follow.

Have students make place-based journals for use throughout the module. These can be made from notebooks with sturdy covers, or from drawing paper and clipboards. Provide each student with a plastic zipper-lock bag for journaling supplies (e.g., pencils, sharpeners, pencil crayons [rather than markers, which will bleed if wet], stretch gloves for journaling on cooler days). Have students use their place-based journals to record their thoughts, feelings, and observations for any outdoor activity.

Planning Tips for Teachers

- Organize text sets related to the topics of energy and simple machines. Text sets are resources on a specific theme that include different reading levels, genres, and media (e.g., fiction, nonfiction, videos, audio recordings, songs, maps, photographs, artwork). Include high-quality books with detailed illustrations and photographs to pique students' interest in energy and simple machines. Use these resources at the learning centre, at the Makerspace, and for general reference throughout the module. See Resources for Students, page 68, for suggestions. Ask your school librarian, district library services, or public library staff to help collect relevant resources.
- Local Elders or Knowledge Keepers may be willing to share stories and knowledge related to the module. Many school districts have consultants or support teachers who can help teachers connect with Elders or Knowledge Keepers. Alternatively, contact the education portfolio of a local band council for suggestions. See Indigenous Perspectives and Knowledge, page 9, for considerations when inviting Elders or Knowledge Keepers to the class.
- Preview and bookmark websites appropriate for student use, as well as those for teacher reference.
- Collect materials and science equipment required for specific lessons. The materials and equipment needed to complete some activities are extensive. Review the materials list for each lesson ahead of time and make a note of items students may be able to bring from home (e.g., plastic containers, cups, spoons, toy cars), as well as specific science equipment such as pulleys and gears.
- Keep all charts and displays created during each lesson, as well as data recording sheets and any other completed work. These are often referenced again in subsequent lessons, and all charts will be used in the concluding lesson, which is a final inquiry project.
- Record the guided inquiry question for each lesson (e.g., on a sentence strip) for display throughout related investigations.

Makerspace

Develop a Makerspace. Classroom Makerspaces are usually designed for students to learn together and collaborate on projects. Give students the opportunity to work with various age-appropriate tools, as well as with everyday, arts-and-crafts, and recycled materials. Makerspaces infuse STEAM, an educational approach that uses science, technology, engineering, the arts, and mathematics to promote deeper learning.

For this module, set up a Makerspace in your classroom that encourages informal learning about thermal energy (heat energy), transformation of energy, and simple machines. Collect a variety of materials and equipment that reflect the challenges students might take on.

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Include general materials, such as those listed in the Introduction (page 19), as well as module-specific materials (e.g., cardboard tubes, recycled cardboard, spring scales, gram weights, building materials like LEGO and Meccano, rubber bands, balloons, cardboard boxes of various sizes). Also provide items for take-apart exploration. Include various everyday devices related to thermal energy (heat energy), transformation of energy (e.g., hair dryer, toaster, lanterns, radios, cellphones), and simple machines (old clocks and watches), along with tools (e.g., screwdrivers, pliers, tweezers, magnifying glasses).

SAFETY NOTE: Ensure all materials at the Makerspace are safe to use with students. Consider small parts and potential hazards for students of all ages and abilities who will have access to the Makerspace area. At this age, this exploration needs to be supervised. Engage in a discussion about safety and respect at the Makerspace with students before beginning this module. Also consider student allergies when selecting supplies.

Makerspace projects may include anything related to the concepts of this module. Projects students might initiate include (but are not limited to):

- designing and constructing a solar oven to cook a hotdog or melt a marshmallow
- designing and constructing a model of an efficiently insulated home
- creating a device to measure temperature
- disassembling, examining, and then reassembling devices that include pulleys and gears to maintain or improve efficiency
- creating a device (e.g., model elevator) that uses pulleys to move toys or other loads
- using a 3D design tool (e.g., Tinkercad) to design a system of gears that work together
- creating a crane that moves a block from one place to another
- creating a working model of a bicycle's pedals, gears, and chain
- creating a Rube Goldberg machine (see <www.rubegoldberg.org>)
- building a conveyor belt
- building a functional miniature zip line

Literacy connections that might inspire projects include:

- *Violet the Pilot* by Steve Breen
- *Rosie Revere, Engineer* by Andrea Beaty
- *Incredible Inventions* by Lee Bennett Hopkins
- *The Boy Who Harnessed the Wind* by William Kamkwamba and Bryan Mealer
- *Energy Island: How One Community Harnessed the Wind and Changed Their World* by Allan Drummond
- *How Do You Lift a Lion?* by Robert E. Wells
- *Stuck* by Oliver Jeffers
- *The Chicken Problem* by Jennifer Oxley
- *Stuck in the Mud* by Jane Clarke
- *Toy Stories: Photos of Children From Around the World and Their Favourite Things* by Gabriele Galimberti
- *Bug in a Vacuum* by Melanie Watt

As inquiry questions are posed with each lesson, these questions may inspire other projects based on the interests of students. Students may determine solutions to these questions through the creating they do at the Makerspace. Remember not to direct the learning here; simply create the conditions for learning to happen.

Science Vocabulary

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

- *applied force, bevel gear, chemical, conduction, convection, direction, elastic, electrical, energy, first-class lever, force, friction, fulcrum, gear, gear train, grade, gravitational, heat, idle gear, inclined plane,*

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input, kinetic, lever, light, load, machine, magnetic, mechanical, motion, muscular, nuclear, output, particle, potential, power, pulley, radiant, radiation, screw, second-class lever, simple machine, simple pulley, sound, speed, spur gear, thermal, third-class lever, transfer, transform, worm gear

Introduce this vocabulary throughout the module through discussions and investigations. A class word wall and student-created science glossaries provide opportunities for students to identify new vocabulary, co-construct meaningful definitions, share visuals and diagrams, and use the vocabulary in context.

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 Big Ideas. Have students identify which skills they are being asked to use as they work in particular lessons. Discuss how the skill looks and sounds as students explore and investigate. Vocabulary related to scientific inquiry skills includes:

- *access, ask, brainstorm, collect, compare, connect, consider, construct, cooperate, create, describe, develop, estimate, explain, explore, find, follow, graph, identify, improve, investigate, measure, observe, order, plan, predict, recognize, record, repeat, research, respond, select, sequence, test*

Early in the module, create a word wall on a bulletin board, poster paper, or chart paper. Record new vocabulary on the word wall as it is introduced in the module. Place the word wall in a location where all students can see and refer to the words during activities and discussion. Have students work with the terms on a regular basis by creating their own definitions, giving examples, linking terms in sentences, and using terms in context. For this purpose, a Science Glossary (3.2) is included with the module.

NOTE: The word wall and Science Glossary may include vocabulary in languages other than English, including Indigenous languages, reflective of the class cultural makeup. This is a way of acknowledging and respecting students' cultural backgrounds while enhancing learning for all students. Use online dictionaries as a source for translations. For example:

- Freelang.net's Haida-English-Haida dictionary at <http://www.freelang.net/online/haida.php>
- FirstVoices' Halq'eméylem language resources at <https://www.firstvoices.com/explore/FV/sections/Data/Salish/Halkomelem/Halq'eméylem>

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Curriculum Learning Framework: What We *Know* and *Understand*

In keeping with the Know, Do, Understand model highlighted in BC's curriculum, consider the Big Ideas in the first row of this chart to reflect what we *know*. The Content, listed in the third row, reflects what we *understand*, while the Curricular Competencies Correlation Chart, page 66, represents what we *do*.

Grade	**3**	**4**	**5**
Big Idea	Thermal energy can be produced and transferred.	Energy can be transformed.	Machines are devices that transfer force and energy.
Sample Guiding Inquiry Questions	■ What can be a source of thermal energy? ■ How is thermal energy transferred between objects?	■ What is energy input and energy output? ■ What is energy conservation? ■ What is the relationship between energy input, output, and conservation?	■ How do machines (natural and human-made) transfer force and energy? ■ What natural machines can you identify in your local environment?
Content	■ thermal energy (the energy that comes from the movement of particles within matter) [lessons 1, 2, 3, 4, 5, 6] ■ sources of thermal energy (thermal energy can be produced by chemical reactions [e.g., hand warmers], friction between moving objects, the sun, etc.) [lessons 1, 2, 3, 4, 5, 6] ■ transfer of thermal energy: conduction (touching [e.g., hold an ice cube]); convection (current—why do we hang mittens over a heat source?); radiation (through space by a wave [e.g., heat from the sun]) [lessons 1, 2, 3, 4, 5]	■ Energy has various forms: the energy of motion (kinetic), light, sound, thermal, elastic, nuclear, chemical, magnetic, gravitational, and electrical. [lessons 1, 2, 3, 4, 5, 6] ■ Energy is conserved: energy cannot be created or destroyed but can be changed. [lessons 3, 4, 5, 6] ■ Devices that transform energy change input energy into a different output energy (e.g., glow stick [chemical to light], windup toy [elastic to mechanical], flashlight [electrical to light]). [lessons 3, 4, 5, 6]	■ properties of simple machines (lever, wedge, inclined plane, wheel and axle, pulley, and screw) [lessons 7, 8, 9, 10, 11, 12, 13, 14, 15] ■ force effects of simple machines (changing direction and multiplying force) [lessons 7, 8, 9, 10, 11, 12, 13] ■ constructed machines: combinations of simple machines form complex machines [lessons 7, 16] ■ machines found in nature (e.g., lever in joints) [lessons 8, 11] ■ power: the rate at which energy is transferred (e.g., students racing up a hill, machine power ratings, motors) [lesson 6]
Core Competencies	*Thinking* *Communication* *Social and Personal*		

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Curricular Competencies Correlation Chart: What We *Do*

Throughout this module, students will develop Curricular Competencies by participating in rich learning experiences that focus on specific skills, strategies, and processes.

Curricular Competencies	Lessons															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
QP Questioning and Predicting																
Demonstrate curiosity about the natural world, scientific topic, or problem.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Make observations in familiar or unfamiliar contexts.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Identify questions about familiar objects and events that can be investigated through scientific inquiry.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Make predictions based on prior knowledge and the findings of their inquiry.	√	√	√	√	√	√		√	√	√		√			√	
PC Planning and Conducting Investigations																
Suggest ways to plan and conduct an inquiry to find answers to their questions or to solve problems.					√			√					√			√
Decide which variable should be changed and measured for a fair test.					√			√					√			√
Consider ethical responsibilities when deciding how to conduct an experiment.					√					√			√			
Safely use appropriate tools to make observations and measurements, using formal measurements and digital technology as appropriate.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Make observations about objects and events.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Observe, measure, and record data.				√	√	√		√	√			√	√	√		√
PA Processing and Analyzing Data and Information																
Experience and interpret the local environment.	√		√	√	√	√				√						
Identify First Peoples perspectives and knowledge as sources of information.	√	√		√	√	√		√	√			√			√	√

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Curricular Competencies	Lessons															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Sort and classify data and information using drawings or provided tables.	√		√	√											√	
Use tables, graphs, and digital technologies to represent data and show patterns or relationships in data.	√		√		√							√	√			
Compare results with predictions, suggesting possible reasons for findings.	√	√	√	√	√	√		√		√	√	√			√	
AI Applying and Innovating																
Contribute to care for self, others, and community through personal or collaborative approaches.	√			√	√		√	√	√	√						
Cooperatively design projects.				√			√	√	√			√				√
Transfer and apply learning to new situations.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Generate and introduce new or refined ideas when problem solving.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
E Evaluating																
Make simple inferences based on their results and prior knowledge.	√	√	√	√	√	√	√	√	√	√						
Reflect on whether an investigation was a fair test.				√	√			√	√				√			
Demonstrate an understanding and appreciation of evidence.				√	√			√					√			
Identify some simple environmental implications of their and others' actions.	√				√				√			√				
C Communicating																
Represent and communicate ideas and findings in a variety of ways, such as diagrams and simple reports, using digital technologies as appropriate.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Express and reflect on personal, shared, or others' experiences of place.	√		√	√	√	√			√							

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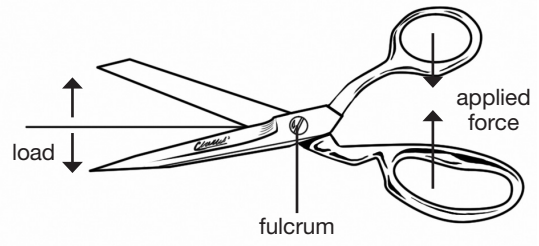
8 How Does a Lever Make Work Easier?

Information for Teachers

A *lever* is a rigid bar that rests on a fixed pivotal point called the *fulcrum*. The lever helps make work easier through use of force and distance. There are three types of levers—first-class, second-class, and third-class. The class of lever is determined by the location of the fulcrum with relation to the load and the applied force (effort force).

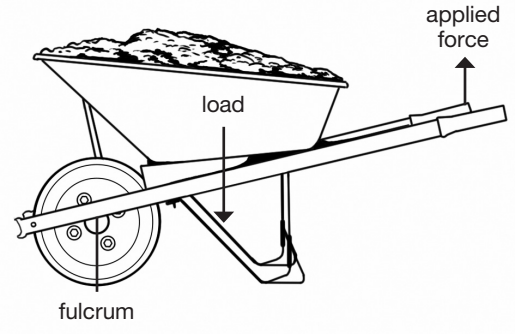
NOTE: Find the following illustrations in the Image Bank: Levers. See Appendix, page 163.

First-class lever: The fulcrum is between the applied force and the load (e.g., seesaw, car jack, scissors, pliers).



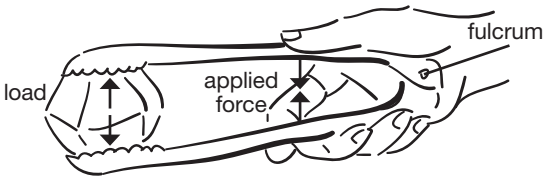
In devices such as scissors, two levers are connected in the middle with a moving pivot that acts as the fulcrum. Squeezing the two levers together (applied force) cuts the paper (load) at the opposite end.

Second-class lever: The fulcrum is at one end and the load is between the fulcrum and the applied force (e.g., wheelbarrow, hammer removing a nail, nutcracker).



On a wheelbarrow, the wheel acts as the fulcrum. Lifting the handles (applied force) allows the wheelbarrow's contents (load) to be moved more easily, and with less effort.

Third-class lever: The fulcrum is at one end and the applied force is between the fulcrum and the load (e.g., tongs; tweezers; a human arm moving a baseball bat, tennis racket, golf club, hockey stick, broom, rake).



Third-class levers do not give mechanical advantage (they do not make work easier) but they do increase speed and power. In many cases, the device becomes an extension of the arm, which is a third-class lever. The arm works with the device to move a load.

First-class and second-class levers are force multipliers. This means that they reduce the force needed to do work, usually to lift a load. The amount of total energy used to do the work doesn't change, but less force is required. Third-class levers are motion multipliers.

Materials

- various common levers (e.g., crowbar, scissors, hammer, pliers, wheelbarrow, tweezers, tongs)
- small boxes or containers (e.g., jewellery boxes, dollar-store containers) filled with sand or rice (one for each working group)
- Image Bank: Seesaw
- Template: Levers (8.1)

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- triangular prisms (e.g., geometric solids, chocolate bar boxes) (one for each working group)
- chart paper
- paper
- markers
- long pencils (one for each working group)
- 30-cm rulers (two for each working group)
- coins
- masking tape
- Image Bank: Paddles (see Appendix, page 163)
- canoe or kayak paddle
- cameras

Engage

Display various common levers (e.g., crowbar, scissors, hammer, pliers, wheelbarrow, tweezers, tongs), and give students time to examine them. As they explore, challenge students to identify what the objects have in common.

When students have had time to examine the levers, review the examples one by one, and discuss with students how each one makes work easier. For each item, ask:

- What is this object's name?
- How is it used?
- When do we use it?

When all items have been reviewed, ask students:

- What is the same about how each of these objects works?

Record the term *lever* on chart paper, and record students' ideas about the examples of this machine.

Introduce the guided inquiry question: **How does a lever make work easier?**

Explore Part One

Project or display the Image Bank: Seesaw.

Explain that the diagram is an example of a *first-class lever*. Explain to students that the horizontal board on the seesaw is supported by a stand called the *fulcrum*. A person who sits on one end of the seesaw is the *load*, and the person who sits at the other end of the seesaw shows the *applied force*. Record these terms on chart paper.

Have students discuss how the seesaw works and share experiences with similar play structures and devices. Explain that the seesaw is an example of a lever. Ask:

- How does the seesaw help make work easier?
- Are the children the same size?
- Why are they still able to go up and down on a seesaw?
- Can an adult and a child operate a seesaw together easily?
- Can the child lift the adult easily?
- What can be done to help the child lift the adult?

Have students share their ideas.

Explain to students that they will now conduct their own seesaw experiment. Organize the class into working groups and provide each group with a 30-cm ruler, a long pencil, coins, and masking tape. Have students create their own recording sheets, or provide each student a copy of the Template: Levers (8.1):

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Date: _____ Name: _____

Levers

Load: Number of Coins	Distance From Fulcrum to the Load (cm)	Distance From Fulcrum to the Applied Force (cm)	Applied Force (Number of Coins) Needed to Lift Load	
			Prediction	Result
5	15 cm	15 cm		
5	5 cm			
5	10 cm			
5	20 cm			
5	25 cm			

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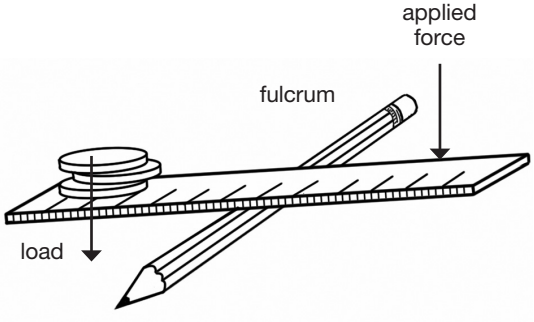
8.1

Download this template at <https://www.portageandmainpress.com/isbn/9781553798781>.

Have the groups construct model seesaws by placing the ruler on top of the horizontal pencil. The pencil acts as the fulcrum, allowing the ends of the ruler to move up and down.

Now, have students tape five coins to one end of their ruler. Explain that the coins will act as the load to be lifted on the seesaw.



Give students time to manipulate the materials, lifting the load by pushing down on the other end of the ruler, and moving the fulcrum. Ask:

- Does changing the position of the fulcrum affect the amount of applied force required to lift the load?

Guide students as they conduct the experiment. Have them place the fulcrum at the 15-cm mark on the ruler. Ask:

- What is the distance from the fulcrum to the load?

Have students record this measurement on the activity sheet. Ask:

- How many coins do you think you will need on the other end of the lever to lift the load?

Have students record their predictions, conduct the experiment, and record the number of coins needed to lift the load. Ensure that they compare actual results to their previous predictions.

Have students continue with the experiment, changing the position of the fulcrum with each test. With every change, ask them to predict (and record), and then measure and record, the number of coins needed to lift the load. Again, compare results with predictions.

Once students have completed the investigation, discuss their results. Ask:

- If you move the fulcrum closer to the load, how does this affect how much applied force is needed to lift the load?
- If you move the fulcrum farther away from the load, how does this affect how much applied force is needed to lift the load?
- What conclusions can you draw?
- Based on what you have learned, can a child and an adult use a seesaw together easily? How?

8

Following this investigation, ask:

- Was this experiment a fair test?
- How do you know?
- What did we do to control a variable?
- Which variable changed?
- How did the experiment show us evidence?

Use this opportunity to share with students an understanding and appreciation of evidence.

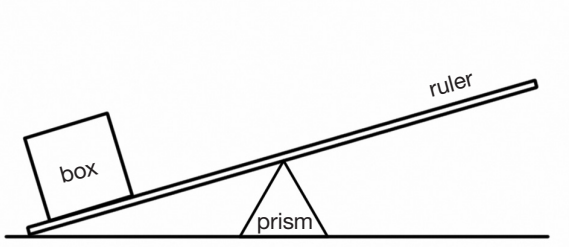
Formative Assessment PC
Observe students as they investigate first-class levers. Focus on their ability to:

- measure accurately
- make predictions
- record results
- demonstrate an understanding of balanced and unbalanced forces

List these criteria on the RUBRIC, page 53, and record observations. Provide descriptive feedback based on students' ability to observe, measure, and record data.

Explore Part Two

Organize the class into working groups, and provide each group with a ruler, a triangular prism, and a small box or container filled with sand or rice. Review with students the three components of a lever—applied force, load, and fulcrum. Review that a seesaw is an example of a first-class lever. Challenge students to use the materials provided to make model seesaws, as in the diagram below:

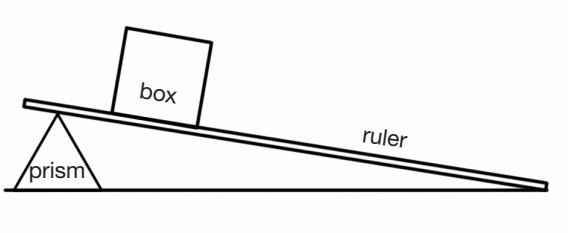


As a class, identify the components of the model levers made by students. Ask:

- Which part is the fulcrum? (triangular prism)
- Which part is the lever? (ruler)
- Which part is the load? (box)
- To lift the load, what is required? (applied force)
- In what direction is the force applied? (downward push)
- What are other examples of first-class levers?

Have students identify first-class levers from the collection displayed during the Engage activity.

Next, explain that the parts of the lever are in different positions in a *second-class lever.* A wheelbarrow is an example of a s*econd-class lever.* Challenge students to use the materials to construct model wheelbarrows, as in the example below.



Have students demonstrate how their model second-class levers work. Ask:

- How is this lever different from the first-class lever?
- Where is the fulcrum?
- Where is the load?
- In what direction is the force applied? (upward pull)
- What are some other examples of second-class levers?

Have students identify examples of second-class levers from the Engage collection.

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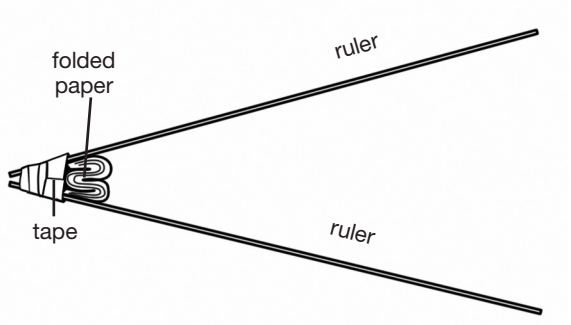
Explore Part Three

Now, introduce the *third-class lever*, which is usually used for moving loads. Pass around tongs and tweezers, which are both examples of *third-class levers*, for students to examine and discuss. Ask:

- Can you use the same materials as before (prism, ruler, and weighted box or container) to make a model of a third-class lever?
- Why is this difficult?
- How could you make a third-class lever?

Hand out recycled paper and an additional ruler to each group and challenge students to use the paper, as well as the materials from the previous activity, to make third-class levers.

NOTE: This task may be challenging for students. A third-class lever often consists of two levers or rigid bars working together. The levers are connected at the fulcrum and used together to move a load. Students may discover that they can make a simple model using two rulers, paper, and tape. The paper can be folded up and taped between the ends of the two rulers to spread them apart and act as a fulcrum, as shown in the diagram below.



Once students have made models of third-class levers, ask:

- In what direction is the force applied with the third-class lever? (both up and down, by squeezing the two levers together toward the middle)

Finally, have students draw labelled diagrams of the various kinds of levers. Encourage them to use the terms *fulcrum*, *load*, and *applied force* in each diagram.

Explore Part Four

Explore machines found in nature. Ask:

- Do you think that there are levers in the human body?

Have students discuss this concept. Encourage them to consider how the joints of the human body are like levers by sharing descriptive sentences, such as:

- My thumb and finger are like a pair of tongs that can be used to pick up things.
- My arm is like a lever. The elbow is the fulcrum.

Also have students discuss examples of levers in other animals. For example:

- A bird's beak is a lever that helps it get food.
- A wolf's legs are like levers that use muscular energy to move.

Have students work in pairs to find and print images of animals, and then label the images with examples of levers and include the *fulcrum*, *load*, and *applied force*.

Explore Part Five

Display the Image Bank: Paddles. As a class, discuss the images, focusing on the design and materials used to construct canoes and paddles. Have students share knowledge and experiences of paddling.

Invite an Elder, Knowledge Keeper, or Indigenous community member to guide the class in exploring how Indigenous peoples used paddles as levers, and how canoes were used to travel, turning waterways into major transportation

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routes. Alternatively, conduct the following demonstration.

NOTE: See Indigenous Perspectives and Knowledge, page 9, for guidelines for inviting Elders and Knowledge Keepers to speak to students.

Show students how a paddle is used in a canoe. Sit on a chair, pretending to be seated in a canoe, and use a canoe paddle to demonstrate how it would be used. For example, the forward or "cruising" stroke is made by reaching forward with the paddle and placing the blade in the water, away from the hull of the canoe and at a right angle to its centre line, and then drawing the paddle straight back. Have students try the same action. Focus on the pulling back of the paddle and the forward motion of the canoe. Encourage students to use related positional language, as well as terms such as *push*, *pull*, *force*, *energy*, *motion*, and so on. Ask:

- What type of lever do you think the paddle is?

Have students share their ideas and provide a rationale through demonstration with the paddle. Repeat the demonstration with a kayak paddle, and have students compare and contrast how the two are used.

NOTE: The paddle is an example of a second-class lever, as the load is in the middle, between the applied force and the fulcrum. The load of the paddle rests in the paddler's hand, holding the paddle steady. The blade dipped in the water acts as a fulcrum. Effort is applied at the top grip point of the paddle by pushing it forward as the blade moves backward. This causes the canoe to move forward. The blade comes out of water as the canoe moves; the blade is then dipped back into the water to make a new fulcrum.

Follow up this exploration by planning a field trip to a location where students have an opportunity to learn paddling. Nature centres and local paddling, boating, watercraft, and water safety organizations often provide this experience.

SAFETY NOTE: Ensure proper safety practices, according to school policy, anytime students are near water.

Before visiting this location, be sure to review with students the importance of being respectful of nature and review the anchor chart created in lesson 1. As with all place-based learning activities:

- Identify the importance of place. Use a map of the local area to identify where the location is in relation to the school.
- Identify on whose traditional territory the school is located, the traditional territory of the location for the place-based learning, and the traditional names of both places.
- Incorporate land acknowledgment using local protocols.

Review any other protocols for field trips and place-based learning, providing students with opportunities to ask questions and clarify expectations.

During the field trip, have students take photographs, and draw labelled diagrams and record observations, ideas, and emotions related to the natural setting in their place-based journals.

Explore Part Six

As a class, review the examples of levers explored in the various activities. Ask:

- What is a lever?
- How would you define a lever, based on these examples?

Record students' ideas and then co-construct a class definition for the term. Encourage students to use the term in sentences to strengthen their understanding.

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Expand

Have students explore levers further by posing their own inquiry questions for personalized learning. They may wish to:

- Initiate a project at the Makerspace, such as investigating how marionette puppeteers use levers to operate puppets' limbs. Students may wish to create their own marionettes. (See "How to Make a Marionette" at <www.youtube.com/watch/?v=eLa2-zOr-Fg>.)
- Write a story to perform using marionettes.
- Research the history of the seesaw and other playground equipment that use simple machines. (See "How We Came to Play: The History of Playgrounds" by Kaitlin O'Shea at <https://savingplaces.org/stories/how-we-came-to-play-the-history-of-playgrounds/#.VuRXvcc-C3I>.)
- Conduct an investigation or experiment based on their own inquiry questions.

As students explore and select ideas to expand learning, provide support and guidance as needed, and offer access to materials and resources that will enable students to conduct their chosen investigation.

Embed Part One: Talking Circle

Revisit the guided inquiry question: **How does a lever make work easier?** Have students share their knowledge and experiences, provide examples, and ask further inquiry questions.

Embed Part Two

- Add to the pyramid chart (from lesson 3) as students learn new concepts, answer some of their own inquiry questions, and ask new inquiry questions.
- Add new terms and illustrations to the word wall. Include the words in languages other than English, such as Indigenous languages, as appropriate.
- Have students add new terms, diagrams, and definitions to their Science Glossary (3.2). When possible, encourage them to add words and examples in languages other than English, including Indigenous languages, reflective of the class cultural makeup.
- Focus on students' use of the Core Competencies. Have students reflect on how they used one of the Core Competencies—Thinking, Communication, or Personal and Social Skills—during the various lesson activities. Project a CORE COMPETENCY DISCUSSION PROMPTS template (pages 38–42) and use it to inspire group reflection. Referring to the template, choose one or two "I Can" statements on which to focus. Have students use the "I Can" statements to provide evidence for how they demonstrated that competency. Ask questions directly related to that competency to inspire discussion. For example:
  - How did you take responsibility for your learning today? (Personal Awareness and Responsibility)

  Have students reflect orally, encouraging participation, questions, and the sharing of evidence. (See page 29 in the Introduction for more information on these templates.)

  As part of this process, have students set goals. For example, ask:
  - What would you do differently next time and why?
  - How will you know if you are successful in meeting your goal?
- To further encourage self-reflection, provide prompts students can use to cite examples of how they have used the Core Competencies in their learning. For this purpose, use the CORE COMPETENCY SELF-REFLECTION FRAMES (pages 43–47) throughout ▶

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the learning process. Five frames are provided to address the Core Competencies: Communication, Creative Thinking, Critical Thinking, Positive Personal and Cultural Identity, and Personal Awareness and Responsibility. Conference individually with students to support self-reflection or have students complete prompts using words and pictures.

Again, involve students in goal-setting by having them consider what they might do differently on future tasks and how they will know if they are successful in meeting their goal.

NOTE: As students become more skilled, they may be able to reflect on additional (two to three) Core Competencies at the same time. Students should be able to identify how a Core Competency was reflected in the activity, and determine what worked, what was a challenge, and what to do next.

NOTE: Use the same prompts from these templates over time to see how student thinking changes with different activities.

Enhance

- Invite an Indigenous canoe builder to conduct a workshop with the class, demonstrating how birchbark canoes are made. Alternatively, have students view "Making a Birch Bark Canoe with Tom Byers" at <https://www.youtube.com/watch?v=k2leKfPyBbU>.
- Project or display the Image Bank: Building and Testing Levers (see Appendix, page 163). Have students construct levers using recycled materials, as in the image bank example.
- Have students test and measure the force needed to lift different loads using a spring scale. They can also experiment with the position of the fulcrum to see how this affects results.
- After building second- and third-class levers, challenge students to determine how they could test the efficiency of the levers, developing and then testing their own criteria. Have students design and conduct their own experiments.

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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.

1. Go to the Portage & Main Press website at **<https://www.portageandmainpress.com/isbn/9781553798781>**.

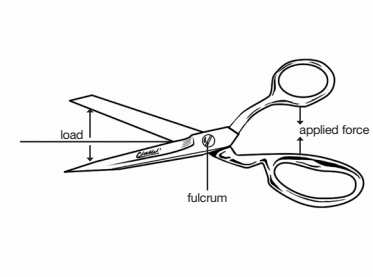
NOTE: The carets (< and >) are not part of the above URL.

2. On the product page, select the button labelled Download Digital Resources. A new page will appear, requesting a password.
3. Type the password xxxxxxxxxxxxxxxxxxx into the password field. The password is case sensitive, so be sure to use the correct capitalization.
4. Select Submit. A new page will appear, listing the download options for this book.
5. Click Retrieve Your Download to download the digital resources, including the image banks and reproducibles for this book.
6. Save the file to the desired location on your computer.

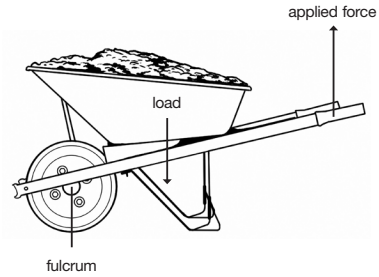
NOTE: This is a large file. Download times will vary your internet speed.

Lesson 8: How Does a Lever Make Work Easier?

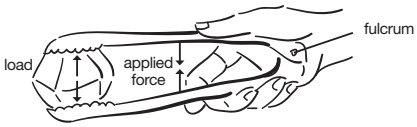
Levers



1. First-class lever



2. Second-class lever



3. Third-class lever

Image Credits:

1 – © Portage & Main Press
2 – © Portage & Main Press
3 – © Portage & Main Press

Seesaw

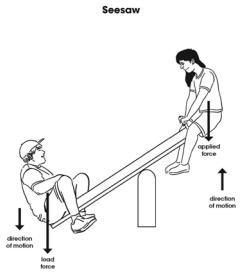


Image Credit:

1 – © Portage & Main Press

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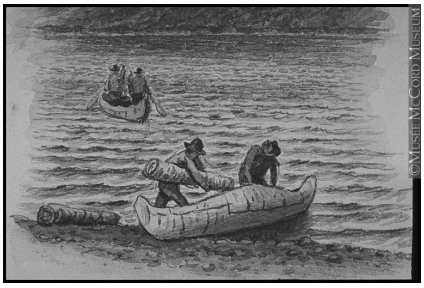
Paddles

1. Kayaking using paddles

2. Canoeing using paddles

3. Paddlers



4. Mi'kmaq canoers

Image Credits:

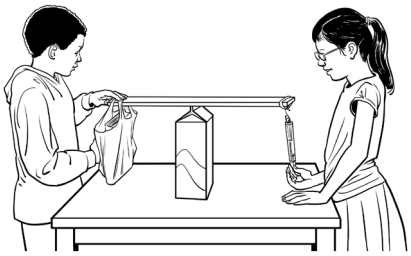
1 – "Tandem Kayaking" by Flickr user Happiness Without. Used under CC by 2.0 licence.

2 – "Canoe" by Flickr user RichardBH. Used under CC by 2.0 licence.

3 – "Paddlers" by Flickr user Donal Lee Pardue. Used under CC by 2.0 licence.

4 – McCord Museum M11443.

Building and Testing Levers



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Date: _____ **Name:** _____

Levers

Load: Number of Coins	Distance From Fulcrum to the Load (cm)	Distance From Fulcrum to the Applied Force (cm)	Applied Force (Number of Coins) Needed to Lift Load	
			Prediction	Result
5	15 cm	15 cm		
5	5 cm			
5	10 cm			
5	20 cm			
5	25 cm			

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About the Contributors

Jennifer Lawson, PhD, is the originator and senior author of the Hands-On series in all subject areas. Jennifer is a former classroom teacher, resource/special education teacher, consultant, and principal. She currently teaches at the university of Manitoba in the faculty of education and continues to develop new Hands-On projects. Jennifer also serves as a school trustee for the St. James- Assiniboia School Division in Winnipeg, Manitoba.

Rosalind Poon has been a science teacher and Teacher Consultant for Assessment and Literacy with the Richmond School District for the past 18 years. In her current role, she works with school teams to plan and implement various aspects of the curriculum by collaborating with teams in professional inquiry groups on topics such as descriptive feedback, inquiry, assessment, and differentiation. Her passions include her family, dragon boating, cooking with the Instant Pot, and making sure that all students have access to great hands-on science experiences.

Melanie Nelson is from the In-SHUCK-ch and Stó:lō Nations, and has experience teaching kindergarten through grade 12, as well as adults in the Lower Mainland of British Columbia. She has taught in mainstream, adapted, modified, and alternate settings, at the classroom, whole school, and district levels. Trained as an educator in science, Melanie approaches Western science through an Indigenous worldview and with Indigenous ways of knowing. Her Master of Arts thesis explored the experience of Indigenous parents who have a child identified as having special needs in school, and she is currently completing a Doctor of Philosophy in School Psychology at the University of British Columbia.

Lisa Schwartz has been a Teacher Consultant for Assessment and Literacy with the Richmond School District for the past six years. As a consultant, Lisa facilitates professional learning with small groups and school staff on topics such as the redesigned curriculum, Core Competencies, differentiation, inquiry, and assessment. She also works side by side with teachers, co-planning, co-teaching, and providing demonstration lessons to highlight quality research-based instruction that supports all learners. Lisa is passionate about engagement, joyful learning, and success for all students.

Desiree Marshall-Peer, MA, BSC, is a Cree-Ojibway educator focusing on re-envisioning the British Columbia education system in innovative ways. Desiree has several years' experience with the BC Ministry of Education renewed curriculum and competencies, with input on graduation transformations and assessment. She has certification in Design Thinking and Maker philosophy. Desiree is currently a professor at the UBC-Okanagan School of Education.

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