hands-on science and Technology
An Inquiry Approach

Grade 5

Series Editor
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Hands-On Science and Technology, Grade 5
An Inquiry Approach

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Introduction to

*Hands-On Science and Technology, Grade 5*
Introduction to Hands-On Science and Technology

Program Introduction

Hands-On Science and Technology helps develop students’ scientific and technological literacy through active inquiry, problem solving, and decision making. With each activity in the program, 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 young students to develop scientific and technological literacy, concrete experience is of utmost importance—in fact, it is essential.

The Inquiry Approach to Science and Technology

As students explore science and technology concepts, they should be 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, the teacher becomes the facilitator of the learning process, and students initiate questions; gather, organize, interpret, and analyze information; evaluate findings and draw conclusions; and communicate their learning. As such, the process focuses on students’ self-reflections as they ask questions, discover answers, and communicate their understanding.

Using an inquiry approach involves beginning with more structured inquiry, and moving to guided inquiry and, finally, open inquiry.

- In structured inquiry, the teacher may provide the initial question and structure the procedures to answer that question. Students follow the given procedures and draw conclusions to answer the given question.
- In guided inquiry, the teacher provides the research question, and students are involved in designing ways to answer the question and communicate their findings.
- In open inquiry, students formulate their own question(s), design and follow through with a developed procedure, and communicate their findings and results. According to Banchi and Bell (2008), “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.”

In implementing an inquiry approach to science and technology, questions and ideas form the foundation of the teaching and learning process. The following excerpt from the Ontario Literacy and Numeracy Secretariat speaks clearly to this approach:

While all students ask questions and express interests in world phenomena, it takes creative and responsive teaching to transform wonder into knowledge. To begin, inquiry works best in a classroom in which ideas are placed at the centre. Establishing a culture in which students are encouraged to express ideas but also to respectfully challenge and test one another’s ideas is an important first step in the inquiry process. This spirit of inquiry is achieved by welcoming ideas and trusting that even the simplest questions can lead to something greater and not yet evident. Like any good growing system, these questions need time to germinate. Students’ ideas can be expressed in many forms (questions, comments, diagrams, pictures, dance, etc.) and serve the important purpose of advancing student understanding of a topic. When the classroom culture is one that...
views ideas as improvable, students work hard to continuously improve the quality, coherence and utility of ideas—both individually and collectively (Scardamalia 2002).

21st Century Teaching and Learning

In this rapidly changing and globalized world, it is more important than ever to prepare students from many different backgrounds to lead fulfilling lives, be productive contributors, and thrive in our society. Educators are responding to this challenge through evolving practice that challenges students in engaging and meaningful ways that encompass diverse student perspectives. The Hands-On Science and Technology program responds to this challenge by ensuring it reflects best practices that focus on 21st Century Competencies. According to Michael Fullan (2013), these competencies are:

- **Critical thinking**—the ability to explore problems, weigh alternate solutions, and arrive at solutions. It also involves problem solving and making effective decisions, and applying them to real-world contexts.
- **Communication**—the ability to communicate effectively through reading, writing, speaking, listening, viewing, and representing. Communication also involves the ability to use a variety of information sources and digital tools.
- **Collaboration**—the ability to work in teams, learning from and contributing to the learning of others.
- **Creativity**—exploring new ideas, being innovative, and thinking outside the box. Being creative also means looking at novel ideas and finding ways to put ideas into action.
- **Citizenship**—thinking like both a local and a global citizen, considering the values and worldviews of others, and having a genuine interest in solving complex real-world problems that affect human and environmental sustainability.
- **Character**—showing traits such as perseverance, resilience, and being a lifelong learner.

These competencies are the foundation of the inquiry-based approach used in Hands-On Science and Technology. As such, teachers take on a facilitation role as students use these skills to explore, investigate, research, design, create, and solve problems in the world around them. To provide a connection between science and technology activities and 21st Century Competencies, each lesson in Hands-On Science and Technology, Grade 5 identifies one or more competencies teachers may focus on during the activity. This provides teachers with the opportunity to make ongoing links between the science and technology curriculum and 21st century classroom teaching and learning.

The Goals of the Science and Technology Program

Science and technology play fundamental roles in the lives of Canadians. In the introduction to The Ontario Curriculum, Grades 1–8: Science and Technology (2007), the Ministry of Education states:

During the twentieth century, science and technology played an increasingly important role in the lives of all Canadians. Science and technology underpin much of what we take for granted, including clean water, the places in which we live and work, and the ways in which we communicate with others. The impact of science and technology on our lives will continue to grow. Consequently, scientific and technological literacy for all has become the overarching objective of science and technology education throughout the world.
The Ontario Curriculum identifies three goals that form the foundation of the science and technology program. In keeping with this focus on scientific and technological literacy, these goals are the bases for the lessons in the Hands-On Science and Technology program:

**Goal 1:**
to relate science and technology to society and the environment

**Goal 2:**
to develop the skills, strategies, and habits of mind required for scientific inquiry and technological problem solving

**Goal 3:**
to understand the basic concepts of science and technology

Hands-On Science and Technology Strands and Expectations
For all grade levels, the Ontario science and technology curriculum is organized into four strands:

1. Understanding Life Systems
2. Understanding Structures and Mechanisms
3. Understanding Matter and Energy
4. Understanding Earth and Space Systems

Two sets of expectations are listed for each grade in each strand: (1) overall expectations, and (2) specific expectations.

The overall expectations describe, in general terms, the knowledge and skills students are expected to demonstrate by the end of each grade. There are three overall expectations for each strand in each grade in science and technology.

The specific expectations describe the expected knowledge and skills in greater detail.

NOTE: The overall and specific expectations must all be accounted for in instruction and assessment, but evaluation focuses on the three overall expectations (Ontario Ministry of Education 2010).

The overall and specific expectations for each strand are presented in chart format in the introduction to each unit. Alongside each specific expectation, corresponding lessons are identified.

Hands-On Science and Technology Fundamental Concepts and Big Ideas
Fundamental concepts are key ideas that provide a framework for the acquisition of all scientific and technological knowledge. These concepts also help students to integrate scientific and technological knowledge with knowledge in other subject areas, such as mathematics and social studies. The fundamental concepts addressed in the curriculum for science and technology are:

- matter
- energy
- systems and interactions
- structure and function
- sustainability and stewardship
- change and continuity

Big ideas are the enduring understandings students carry with them into the future. Big ideas are often transferable to other subjects and to real-life experiences.

For all grades, the fundamental concepts and big ideas for each strand can be found in a chart in the introduction to each unit of the Hands-On Science and Technology program.
Hands-On Science and Technology Program Principles

- Effective science and technology programs involve hands-on inquiry, problem solving, and decision making.
- The development of students’ skills, attitudes, knowledge, and understanding of Science, Technology, Society, and the Environment (STSE) issues form the foundation of the science and technology program.
- Children have a natural curiosity about science and the world around them. This curiosity must be maintained, fostered, and enhanced through active learning.
- Science and technology activities must be meaningful, worthwhile, and relate to real-life experiences.
- The teacher’s role in science and technology education is to facilitate activities and encourage critical thinking and reflection. Children learn best by doing, rather than by just listening. Rather than simply telling, the teacher should instead focus on formulating and asking questions, setting the conditions so students ask their own questions, and helping students to make sense of the events and phenomena they have experienced.
- Science and technology 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.
- The science and technology program should encompass, and draw on, a wide range of educational resources, including literature, nonfiction material, audio-visual resources, and technology, as well as people and places in the local community.
- The science and technology program should be infused with knowledge and worldviews of Indigenous peoples, as well as other diverse multicultural perspectives.

Assessment of student learning in science and technology should be designed to focus on performance and understanding, and should be conducted through meaningful assessment techniques carried out throughout each unit of study.

Infusing Indigenous Perspectives

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 the Hands-On Science and Technology series helps to address the Calls to Action of the Truth and Reconciliation Commission of Canada (2015), particularly the call to “integrate Indigenous knowledge and teaching methods into classrooms” (clause 62) and the call for “building student capacity for intercultural understanding, empathy, and mutual respect” (clause 63).

Indigenous peoples of the past depended on the natural environment to survive. The environment shaped their way of life: geography, vegetation, climate, and natural resources of the land determined the ways they survived. By observing the land and its animal inhabitants, the environment also taught them how to survive. The traditional territories of the First Nations and Métis peoples cover Ontario, and many Inuit have moved to urban centres in the province. The worldviews of these peoples and their approaches and contributions to science and technology are now being acknowledged and incorporated into educational programs. It is also important to recognize the diversity of Ontario’s Indigenous peoples 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 to you and your students.

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

...the knowledge base acquired by indigenous and local people over many hundreds of years through direct contact with the environment. It includes an intimate and detailed knowledge of plants, animals, and natural phenomena, the development and use of appropriate technologies for hunting, fishing, trapping, agriculture, and forestry and a holistic knowledge, or “worldview” which parallels the scientific disciplines of ecology (Inglis 1993).

Indigenous peoples developed technologies and survived on the land for millennia, in part, because they were good scientists. They used observation and experimentation to refine their technologies such as building canoes and tipis and discovering food-preservation techniques. As such, TEK serves as an invaluable resource for students and teachers of science and technology.

Throughout the Hands-On Science and Technology program, there are many opportunities to incorporate culturally appropriate teaching methodologies from Indigenous worldviews. First Peoples pedagogy indicates that making connections to the local community is central to learning (First Nations Education Steering Committee 2016). As one example, both Elders and Métis Senators offer a wealth of knowledge that can be shared with students. Consider inviting an Elder or a Métis Senator as a guest into the classroom during the study of specific topics. An Elder or a Métis Senator 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 Métis Senators can 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 Métis Senators:

- Some Indigenous keepers of knowledge are more comfortable being called “Knowledge Keepers” than “Elders” or “Métis Senators.” Be sensitive to their preferences.

- It is important to properly acknowledge any visiting Elders or Métis Senators 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 a Métis Senator into your classroom. The Lakehead District School Board has protocols available at: <https://www.lakeheadschools.ca/aboriginal-education/>.

- It is especially important to connect with Indigenous communities, Elders, and Métis Senators in your local area, and to study local issues related to Indigenous peoples in Ontario. Contact family members of students who have self-identified as First Nations, Métis, or Inuit for referrals, as well as Indigenous education consultants within your school district or the Ontario Ministry of Education. Also, consider contacting local Indigenous organizations for referrals to Elders, Métis Senators, and other Knowledge Keepers. Such organizations may also be able to offer resources and opportunities for field trips and land-based learning.

Finally, when incorporating Indigenous artifacts in the classroom, keep in mind that there is cultural significance to some objects made by Indigenous people that should only be shared by Indigenous people. For example, special ceremonies and protocol are performed when a tipi is erected or a drum is ‘birthed,’ or a feather is given. When a canoe is created, there are certain steps and traditions that the canoe builder follows. These are the teachings that an
Indigenous person can share when they create something with students. A non-Indigenous person could re-create a tipi or a wigwam, but they would not be able to share the ceremony that went with it, nor should they, because they are not part of the culture. Instead, they should invite an Indigenous person to share this knowledge and explain the significance to students. The Toronto District School Board’s *Aboriginal Voices in the Curriculum: A Guide to Teaching Aboriginal Studies in K-8 Classrooms* says the following:

Don’t have students create dream catchers, masks, Seven Grandfather Teachings, Medicine Wheel, Totems, Wigwam, or Tipi, feathers/eagles, or other sacred cultural objects except in context, accompanied with discussion and provision of information on its historical and cultural significance and purpose, and preferably in the presence of an Elder or Aboriginal teacher.

### 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.

Throughout the *Hands-On Science and Technology* program, suggestions are made for connecting science and technology topics to cultural explorations and activities.

### Land-Based Learning

Land-based learning replaces the classroom walls with the natural land. For all students, land-based learning offers firsthand opportunities to observe, explore, and investigate the land, waters, and atmosphere of the natural world. Land-based learning promotes a healthy interplay between society and nature and helps students envision a world where there is meaningful appreciation and respect for our natural environment—an environment that sustains all life forms. Many lessons in *Hands-On Science and Technology, Grade 5* incorporate land-based learning activities, whether it be a casual walk around the neighbourhood to examine trees or a more involved exploration of local waterways. When land-based learning connections are made in *Hands-On Science and Technology, Grade 5* lessons, the following icon is used:

![LBL](icon)

### Technology

Digital learning, or learning with information and communication technology (LwICT), is an important component of any classroom. As such, technological supports available in schools—including digital cameras, computers/tablets, interactive whiteboards (IWB), projectors, document cameras, audio-recording devices, and even calculators—can be used with and by students to enhance their learning experiences. When technology connections are made in *Hands-On Science and Technology, Grade 5* lessons, the following icon is used:

![Tech](icon)

### Sustainability

The *Hands-On Science and Technology* program provides numerous opportunities for students to investigate issues related to sustainable development. Asking students the following question can often help to clarify for them what is meant by sustainability: “Is there enough for everyone, forever?” Exploring sustainability...
also connects to Indigenous worldviews about respect and care for the Earth. The three pillars of sustainability are the environment, society, and the economy. When sustainability links are made in *Hands-On Science and Technology, Grade 5* lessons, any or all of the sustainability pillars may be the focus of this connection, and are identified by the following icon:

![Sustainability Icon]

Program Implementation
Program Resources

*Hands-On Science and Technology, Grade 5* is organized in a format that makes it easy for teachers to plan and implement. The book opens with this introduction (which includes assessment reproducibles) and is divided into four units that cover the selected topics of study for the grade level. The units relate directly to the strands, expectations, fundamental concepts, and big ideas outlined in *The Ontario Curriculum, Grades 1–8: Science and Technology* (2007).

Each unit also has its own introduction, which summarizes the general goals for the unit. This introduction provides background information for teachers, planning tips, and lists of vocabulary related to the unit, as well as other pertinent information such as how to embed Indigenous perspectives into the unit of study.

Additionally, the introduction to each unit includes a list of related resources (books, websites, and videos) suitable for students.

Each unit is organized into numbered lessons comprised of topics and activities based on the overall and specific expectations. Lessons are arranged in the following format:

**Lesson title:** The title of each lesson is posed as a guided inquiry question, which is related to the expectations being addressed.

**Information for Teachers:** Some lessons provide teachers with the basic scientific and technological knowledge they will need to present the activities. This information is offered in a clear, concise format, and focuses specifically on the topic of study.

**21st Century Competencies:** At the start of each lesson, the key competencies (critical thinking, communication, collaboration, creativity, citizenship, and character) focused on during the various activities are identified.

**Materials:** A complete list of materials required to conduct the main activities is provided. The quantity of materials required will depend on how you conduct activities. If students are working individually, you will need enough materials for each student. If students are working in groups, the materials required will be significantly reduced. Many of the identified items are for the teacher to use for display purposes, or for making charts for recording students’ ideas. In some cases, visual materials (e.g., large pictures, sample charts, diagrams) have been included with the lesson to assist the teacher in presenting ideas and questions, and to encourage discussion. Some lessons include Image Banks. Black-and-white thumbnails of Image Bank visuals can be found in the Appendix, on page 435. Colour images of these thumbnails can be downloaded from the Portage & Main website. (These images may be displayed or printed, depending on the availability of projectors, their use in specific activities, and the needs of students.)

**Activate:** This activity is intended to activate prior knowledge, review previous lessons, and engage students in the lesson. The guided inquiry question for the lesson is also introduced in this section. Teachers may choose to record
The Hands-On Science and Technology Assessment Plan

The **Hands-On Science and Technology** program 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 assessment for learning, assessment as learning, and assessment of learning.

Ontario’s policy on assessment is outlined in the document *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools* (see: <www.edu.gov.on.ca/eng/policyfunding/success.html>). The document outlines a fundamental shift in the roles of teachers and students in the learning process:

- **In traditional assessment paradigm**, the teacher is perceived as the active agent in the process, determining goals and criteria for successful achievement, delivering instruction, and evaluating student achievement at the end of a period of learning. The use of assessment for the purpose of improving learning and helping students become independent learners requires a culture in which student and teacher learn together in a collaborative relationship, each playing an active role in setting learning goals, developing success criteria, giving and receiving feedback, monitoring progress, and adjusting learning strategies. The teacher acts as a “lead learner,” providing support while gradually releasing more and more responsibility to the student, as the student develops the knowledge and skills needed to become an independent learner.

The **primary purpose of assessment** is to improve student learning. Assessment for learning provides students with descriptive feedback and coaching for improvement. Assessment as learning helps students self-assess by developing their capacity to set their own goals, monitor their own progress, determine their next steps in learning, and reflect on their learning. Assessment of learning is summative in nature and is intended to identify student progress in relation to learning expectations. The challenge for educators is to integrate assessment seamlessly with other learning goals. The Ontario assessment model uses the following process:

- **Establish learning goals from curriculum expectations.** Lessons include learning goals in student-friendly language that have been developed from curriculum expectations. These learning goals are shared with students and used to guide instruction.

- **Develop success criteria.** These descriptors are written in student-friendly language to help students understand what successful learning looks like. Criteria can be established by the teacher, using assessment task exemplars of student work, or by using the Achievement Chart from *The Ontario Curriculum, Grades 1–8: Science and Technology* (2007). Success criteria can also be determined in collaboration with students.

- **Provide descriptive feedback.** In conversations with students, identify what criteria they have and have not met, and provide any needed instruction. At this stage, teachers work with students to identify next steps to determine how students may improve. This may include differentiating instruction.

- **Use information for peer and self-assessment.** Students assess their own work and the work of others to determine what still needs to be done.

- **Establish individual goals.** Students determine what they need to learn next and how to get there.

The **Hands-On Science and Technology** program provides assessment suggestions, rubrics, and templates for use during the
teaching/learning process. These suggestions include tasks related to assessment for learning, assessment as learning, and assessment of learning.

Assessment for Learning

It is important for teachers to assess students’ understanding before, during, and after a lesson. The information gathered helps teachers determine students’ needs and then plan the next steps in instruction. Students may come into class with misconceptions about science and technology concepts. By identifying what they already know, teachers can help students make connections and address any challenging issues.

To assess students as they work, use the assessment for learning suggestions provided with many of the activities.

While observing and conversing with students, teachers may use the Anecdotal Record template and/or the Individual Student Observations template to record assessment for learning data.

- **Anecdotal Record**: To gain an authentic view of a student’s progress, it is critical to record observations during lessons. The Anecdotal Record template, on page 27, provides the teacher with a format for recording individual or group observations.

- **Individual Student Observations**: When teachers wish to focus more on individual students for a longer period of time, consider using the Individual Student Observations template, on page 28. This template provides more space for comments and is especially useful during conferences, interviews, or individual student performance tasks.

Assessment as Learning

It is important for students to reflect on their own learning in relation to science and technology. For this purpose, teachers will find a Student Self-Assessment template, on page 32, as well as a Student Reflections template on page 33.

In addition, the Science and Technology Journal, on page 29, will encourage students to reflect on their own learning. Teachers can copy several sheets for each student, cut the sheets in half, add a cover, and bind the sheets together. Students can then create their own title pages for their journals. For variety, teachers may also have students use the blank reverse side of each page for other reflections, such as drawing or writing about:

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

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

**NOTE**: This Science and Technology Journal template is provided as a suggestion, but journals can also be made from simple notebooks or recycled paper.

Another component of assessment as learning involves opportunities for students to reflect on their use of 21st Century Competencies. During each lesson, teachers should spend time discussing and reflecting on the competencies being focused on. The intent here is to enhance students’ understanding of how and when they use the competencies during the inquiry
process. For this purpose, teachers may project a copy of the 21st Century Competencies Reflection template, on page 30, and complete it as a class, using words and pictures to communicate students’ reflections. A completed Sample 21st Century Competencies Reflection is included on page 31.

NOTE: Since no lesson addresses all six competencies, teachers can focus specifically on those covered in a lesson. Students can then explore the meaning of those skills at a deeper level.

Another component of assessment as learning utilizes the 21st Century Competencies Student/Teacher Reflection template, which is found on page 34. Students complete this at the end of the unit, to encourage them to reflect on how they have used the competencies. Students record their reflections in the rectangles on the template, and teachers provide descriptive feedback in the outer ovals.

NOTE: Depending on their literacy level, students may complete the assessment in various ways. For example, the sheets may be used as guides for oral conferences between teacher and student, or an adult may act as a scribe for the student, recording their responses. Alternatively, students may complete the sheets independently or with guidance and support as needed.

NOTE: This descriptive feedback from teachers may also be considered assessment for learning. Even though this feedback is provided at the end of the unit, students will consider the anecdotal comments as they continue to develop their 21st Century Competencies.

Student reflections can also be done in many ways other than by using these templates. For example, students can:

- Interview one another to share their reflections on science and technology.
- Write an outline or brief script and make a video reflection.
- Create a slide show with an audio recording of their reflections.

Assessment of Learning

Assessment of learning provides a summary of student progress related to the accomplishments of the learning goals at a particular point in time. It is important to gather a variety of assessment data to draw conclusions about what a student knows and can do. As such, consider collecting student products, observing processes, and having conversations with students. Teachers should also consider which student work is formative and which is summative. Only the most recent and consistent evidence should be used.

Assessment of learning suggestions are provided with the culminating lesson of each unit of the Hands-On Science and Technology program. Teachers may use the Anecdotal Record template, on page 27, the Individual Student Observations template, on page 28, and the Rubric, on page 37, to record student results.

Always assess a student’s individual accomplishments, not group work. However, you may assess how an individual student works within a group. Such skill development includes the ability to listen to others respectfully, share ideas, and participate actively in the inquiry process. For this purpose, use the Cooperative Skills Teacher Assessment template on page 38.
Performance Assessment

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

A Sample Rubric and a Rubric template for teacher use are on pages 36 and 37. For any specific activity, before the work begins, the teacher and students should discuss together success criteria for completing the task. This will ensure that the success criteria relate to the lesson’s learning goals. The teacher can then record these criteria on the rubric.

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

When conducting assessment of learning, the rubric can be used to determine summative data. For example, teachers can use the rubric criteria to assess student performance, and students can receive a check mark for each criterion accomplished to determine a rubric score from a total of four marks. These rubric scores can then be transferred to the Rubric Class Record template, on page 39.

When using the rubric for assessment of learning, consider using four levels of achievement to correlate with the Ontario Science and Technology Achievement Chart (see pages 26 and 27 of The Ontario Curriculum).

For example:
1. achievement that falls much below the provincial standard
2. achievement that approaches the provincial standard
3. achievement that meets the provincial standard
4. achievement that surpasses the provincial standard

The Hands-On Science and Technology program provides numerous opportunities for students to apply their skills. By considering the same levels of achievement throughout the year, teachers should be able to track student learning and determine when students have a thorough understanding and demonstrate in-depth application of concepts and skills.

Portfolios

A portfolio is a collection of work that shows evidence of a student’s learning. There are many types of portfolios—the showcase portfolio and the progress portfolio are two popular formats. A showcase portfolio highlights the best of a student’s work, with the student involved in the selection of pieces and justification for choices. A progress portfolio reflects a student’s progress as their work improves and aims to demonstrate in-depth understanding of the materials over time.

Select, with student input, work to include in a science and technology portfolio or in a science and technology section of a multi-subject portfolio. Selections should include representative samples of student work in all types of science and technology activities. Templates are included to organize the portfolio (Portfolio Table of Contents is on page 40, and Portfolio Entry Record is on page 41).

Alternatively, the student and teacher may select completed work from a coming-to-know perspective that reflects participatory learning, and which is common in Indigenous learning culture. With this approach, the student reflects on their own understanding of the world around them and may gain a sense of negotiating other points of view.
Evidence of Student Achievement Levels for Evaluation

At the end of each unit, teachers can determine achievement levels for each student. Assessment of learning information gathered throughout the unit can be used to identify these levels, according to the Ontario Science and Technology Achievement Chart.

The most recent and consistent assessment information should be used to determine levels of achievement. A reproducible, Achievement Chart for Science & Technology, on page 42 and 43, is included for teacher reference.

Important Note to Teachers

Throughout the Hands-On Science and Technology program, suggestions are provided for assessment for learning, assessment as learning, and assessment of learning. Keep in mind that these are merely suggestions. Teachers are encouraged to use the assessment strategies presented in a wide variety of ways, and to ensure they build an effective assessment plan using these assessment ideas, as well as their own valuable experiences as educators.

Teachers should be aware that some Indigenous students might feel apprehensive about a formal process of assessment; others may find Western achievement goals do not fit their own worldviews. Assessment within an Indigenous learning culture tends to be community-based, qualitative, and holistic, and includes input from all the people who influence an individual student’s learning—parents, caregivers, Elders, Métis Senators, educators and other community members. An assessment that includes all these perspectives provides a balanced understanding of what represents success for Indigenous students and their families and community, with an understanding that strong partnership between parents/guardians, communities, and school improves student achievement.
References


Creative Commons. (See: <http://creativecommons.org/>.)


Fullan, Michael. Great to Excellent: Launching the Next Stage of Ontario’s Education Agenda, 2013.


Truth and Reconciliation Commission of Canada: Calls to Action, 2015. (See: <www.trc.ca/>.)

———. The Ontario Curriculum, Grades 1–8: Science and Technology, 2007. (See: <www.edu.gov.on.ca/>.)

———. ———.
Unit 1

Human Organ Systems
Introduction

The focus of this unit of *Hands-On Science and Technology, Grade 5* is the human body, including its various systems and the care of each system. Students will investigate each system and explore ways to maintain healthy bodies through proper nutrition and exercise. They will relate this knowledge to medical advancements and the impact of media influences on lifestyle choices.

Planning Tips for Teachers

- The lessons in *Hands-On Science and Technology, Grade 5* rely on reference materials for both students and teachers (see Resources for Students, page 52), including a good dictionary of biological terms. As much as possible, collect these resources in advance.
- Contact local healthcare organizations and government departments well in advance for classroom materials. There are many resources related to the human body, illness, and disease available for the asking—check with local clinics, dental offices, medical professional offices, hospitals, public health offices, and pharmacies, as well as with national health organizations (e.g., Health Canada, Diabetes Canada, the Lung Association, Canadian Dental Association, Indigenous and Northern Affairs Canada, Indigenous Services Canada).
- Collect nutrition panels from food packages, illustrated grocery-store flyers, food magazines, reference materials about nutritional elements, and cookbooks for children.
- Collect various materials related to and including the Canada Food Guides: *Eating Well With Canada’s Food Guide* and *Eating Well With Canada’s Food Guide—First Nations, Inuit and Métis*. Both are available from Health Canada; the former is available translated into various languages including French, Farsi, Tagalog, and several others, while the latter is tailored specifically to Indigenous peoples and includes both traditional and store-bought foods. Posters, brochures, and even an app, My Food Guide, are also available (see <https://www.canada.ca/en/health-canada.html>).
- Collect in advance specific scientific equipment required for the unit: model of human skeleton, microscopes, slides, cover slips, iodine, and commercially prepared slides of human skin cells.
- Check with the Indigenous lead at your school board office for a list of Elders, Métis Senators, and Knowledge Keepers to visit your classroom.
- Develop a classroom Makerspace centre, where students can learn together and collaborate on do-it-yourself projects. Students are given the opportunity to work with a variety of age-appropriate tools at the Makerspace, as well as everyday, arts-and-crafts, and recycled materials. For this unit, set up a Makerspace centre that encourages informal learning about human organ systems. Collect a variety of supplies that reflect challenges students might take on at the centre. Include general materials, such as those listed in the Introduction to *Hands-On Science and Technology, Grade 5* on page 19, as well as unit-specific materials (e.g., recycled plastic trays; ice-cube trays; measuring cups; lab materials like beakers, graduated cylinders, and pan balances; various models of human body parts and systems; fitness trackers, heart-rate monitors, stop watches, sample x-rays).

**SAFETY NOTE:** Consider any student allergies before including any food as materials at this Makerspace centre.

Do-it-yourself Makerspace projects may include anything related to the concepts within this unit. Some projects that students might initiate include (but are not limited to):

- growing fruits and vegetables
Creating healthy recipes (and practise “technical” writing by composing a list of ingredients and instructions)

- creating healthy recipes (and practise “technical” writing by composing a list of ingredients and instructions)

- designing models of various joints in the body (e.g., ball and socket, hinge, pivot, gliding)

- creating a fitness video

- designing and constructing pedal-powered simple machines

- creating a device that attaches to the human body and helps with an everyday task

- creating a working model of a body organ

- creating a closed-fluid system that uses fluid to power something (similar to blood vessels)

- designing two devices that work cooperatively to perform a task (similar to the body’s organs)

- researching how the same organ may look/act differently in different organisms (e.g., lungs in various creatures)

- creating a device that separates waste or some other substance from a larger sample, similar to how the kidneys and liver work

- researching diseases that are prevalent in certain populations (e.g., diabetes among Indigenous people)

- using an online interactive story and animation program (e.g., Scratch) to create an interactive story that explains how a body organ works

Books that might inspire Makerspace projects with literary connections:

- Good Night Yoga: A Pose-by-Pose Bedtime Story by Mariam Gates

- Exercise: Rookie Read-About Health by Sharon Gordon

- The Thing Lou Couldn’t Do by Ashley Spires

- No Fear! (King of the Bench #1) by Steve Moore

- The Way We Work: Getting to Know the Amazing Human Body by David Macaulay

- Parts by Tedd Arnold

- A Drop of Blood by Paul Showers

- The Help Yourself Cookbook for Kids: 60 Easy Plant-Based Recipes Kids Can Make to Stay Healthy and Save the Earth by Ruby Roth

As inquiry questions are posed with each lesson, teachers will find these questions inspire other do-it-yourself projects related to the unit. Students may determine solutions to these questions through the creating they do at the Makerspace centre. Remember not to direct learning here; simply create the conditions for learning to happen.

Indigenous Worldviews

Throughout this unit of Hands-On Science and Technology, Grade 5, teachers should continue to enhance students’ science and technology education by infusing it with Indigenous perspectives as often as possible. This unit presents opportunity for students to investigate various Indigenous insights and understandings of health and healthy bodies. Traditionally, many Indigenous peoples were hunters and gatherers. These Indigenous peoples sought balance between daily activity and proper nutrition. Recognizing the connection between the person, the food they ate, and their daily activities, Indigenous peoples took an integrative approach toward a balanced mind, body, and lifestyle. Today, this lifestyle continues in some capacity, with some Indigenous communities incorporating some or all aspects of traditional life along with the addition of new foods and medicines.
Science Vocabulary

Throughout this unit of *Hands-On Science and Technology, Grade 5*, teachers should use, and encourage students to use, vocabulary such as:

- *Eating Well With Canada’s Food Guide*, *Eating Well With Canada’s Food Guide—First Nations, Inuit and Métis*, carbohydrate, circulatory system, digestive system, fat, food group, integumentary system, mineral, muscular system, nervous system, nutrient, protein, respiratory system, serving size, skeletal system, vitamin

Due to the extensive new vocabulary presented in this unit, terminology is often suggested within the context of a diagram of the body system. Students tend to make better sense of unfamiliar words through both visual and hands-on experience. Presenting a visual demonstration, such as attaching a “pancreas” to a model of the digestive system, for example, keeps students engaged, possibly inspiring them to find out more about the organ than they would if they were simply told the word *pancreas*.

In lesson 1, students begin a Science and Technology Glossary in which they record new vocabulary introduced throughout the unit. Also in lesson 1, teachers create a word wall for the unit, which can be created on a bulletin board or simply on a piece of poster paper, so as not to take up too much space. On the bulletin board or poster paper, record new vocabulary as it is introduced throughout the unit. Ensure the word wall is placed in a location where all students can easily see and access the words. Refer frequently to new vocabulary, and encourage students to use it in both their writing and conversation.

Throughout the unit teachers should also use, and encourage students to use, vocabulary related to scientific inquiry skills. This vocabulary can be displayed in the classroom throughout the year, as the terms relate to all science and technology units. Teachers and students can then brainstorm which skills they are being asked to use as they conduct particular activities. They can also discuss what that skill looks and sounds like as they 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
**Promoting Scientific Inquiry**

Throughout the inquiry process, it is essential for teachers and students to generate thoughtful questions about the scientific information and issues presented. There are many questioning systems that can be implemented; the point is to apply them to the scientific material within the unit. Often simply changing a question can turn the intent from a focus on knowledge and understanding to an emphasis on scientific inquiry, which can then lead to use of technological problem-solving.

The chart below shows how questions related to topics of study in this unit, and which address specific curriculum outcomes, can either focus on knowledge and understanding (column two) or encourage more in-depth inquiry and higher-level thinking (column three) and then lead to the use of technological problem-solving (column four).

A questioning system such as this can be used by both teachers and students to reach beyond factual content toward rich, inquiry-based investigations.

<table>
<thead>
<tr>
<th>Unit Topic</th>
<th>Knowledge and Understanding (content questions that range in complexity)</th>
<th>Scientific Inquiry (testable questions by students or by scientists)</th>
<th>Technological Problem-Solving (prototype questions designed or critiqued by students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate</td>
<td>What is a pulse?</td>
<td>What impact does exercise have on your pulse?</td>
<td>What is useful information for a fitness tracker to record?</td>
</tr>
<tr>
<td>Skin</td>
<td>Why does the skin need protection from the Sun?</td>
<td>Can tanning be a safe practice?</td>
<td>What features do the best sunscreens have?</td>
</tr>
<tr>
<td>Food choices</td>
<td>How many servings of fruits and vegetables should you have each day?</td>
<td>How is appropriate serving size determined?</td>
<td>Why was the Canada Food Guide recently updated?</td>
</tr>
</tbody>
</table>
Unit Overview

<table>
<thead>
<tr>
<th>Fundamental Concepts</th>
<th>Big Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems and Interactions</td>
<td>■ Organ systems are components of a larger system (the body); they work together and affect one another.</td>
</tr>
<tr>
<td>Structure and Function</td>
<td>■ Organ structures are linked to their functions.</td>
</tr>
<tr>
<td></td>
<td>■ Systems in the human body work together to meet our basic needs.</td>
</tr>
<tr>
<td></td>
<td>■ Choices we make affect our organ systems and our overall health.</td>
</tr>
</tbody>
</table>

Overall Expectations

By the end of Grade 5, students will:

1. Analyze the impact of human activities and technological innovations on human health.
2. Investigate the structure and function of the major organs of various human body systems.
3. Demonstrate an understanding of the structure and function of human body systems and interactions within and between systems.
**Information for Teachers**

The primary function of the respiratory system is to supply blood with oxygen and remove waste carbon dioxide. Blood carries oxygen from the lungs to the body tissues, while also carrying carbon dioxide from the body tissues and out through the lungs. Cellular respiration uses oxygen to convert glucose into usable energy for the body’s cells. Carbon dioxide is released as a waste product of this process.

*Circulation* is the process of moving blood to and from the heart through the blood vessels of the body.

Blood transports nutrients and wastes for the digestive, muscular, skeletal, urinary, excretory, and circulatory systems. The various routes blood takes from the heart connect all parts of the body, and, thus, all systems. The adult human body contains about 4–5 L of blood.

Healthy blood is always red, and brighter when highly oxygenated. Blood vessels, veins in particular, are bluer in colour due to the reflection of certain wavelengths of light back to our eyes. Between the blood and our eyes are tissues that distort what we see.

The main parts of the circulatory system are:

- **Heart**: the fist-sized muscular organ that pumps blood through the blood vessels of the circulatory system
- **Blood vessels**: carry blood throughout the body. The two main types of blood vessels are arteries (carry oxygenated blood from the lungs to the tissues throughout the body) and veins (pick up deoxygenated blood, now carrying carbon dioxide, and transport it back to the heart and out through the lungs).
- **Capillaries**: small connecting “roads” between arteries and veins convey blood throughout almost all body tissues. The thin capillary walls allow smaller molecules of water and salt in and out of the tissues.

**Blood**: made up of red blood cells, white blood cells, and platelets. Red blood cells contain *hemoglobin*, which gives blood its red colour and carries oxygen. White blood cells are essential in fighting bacteria and are part of the immune system. Platelets help wounds to clot (stop bleeding).

**Spleen**: found near the stomach; defends the bloodstream against invading organisms and removes old red blood cells.

The main parts of the respiratory system are:

- **Trachea**: the “windpipe,” a single tube leading from the throat to the lungs, where it splits in two
- **Lungs**: the two organs for breathing in oxygen from the air. The lungs are not identical—the right lung has three lobes, and the smaller left lung has two lobes. Each lung contains alveoli—tiny air sacs surrounded by blood vessels. Respiratory exchange of oxygen and carbon dioxide (a waste product) occurs through the alveoli. There are about 350 million air sacs in a healthy lung.

The average infant takes 30–60 breaths per minute, decreasing to 12–20 breaths as an adult. Every human has a different breathing rate and a different lung capacity. However, large lung capacity is one indicator of a healthy body. If the lungs are exposed to pollution (e.g., cigarette smoke) over time, they lose their ability to absorb oxygen from the air and expel carbon dioxide.

**21st Century Competencies**

**Communication and Collaboration**: Students will gather information about the circulatory system, and communicate their understanding. A large space will then be used to model the functioning of the circulatory system.
Materials
- Activity Sheet A: Video Viewing Guide (1.6.1)
- Diagram: The Circulatory System* (1.6.2)
- Diagram: The Respiratory System* (1.6.3)
- computer/tablet with Internet access
- Vocabulary Cards (Photocopy, cut out, and mount onto stiff cardboard.) (1.6.4)
- Activity Sheet B: The Respiratory and Circulatory Systems (1.6.5)
- chart paper
- markers
- three long pieces of rope (each about 3 m)
- four pails
- red balls
- blue balls
- four pylons
- sticky notes
- projection device
- access to a large space (e.g., gym, playground)
- reference materials about the respiratory and circulatory systems
- KWHL chart (from lesson 1)
- Science and Technology Glossary (1.1.1)

*NOTE: These diagrams are also available as image bank files. See Appendix, page 435.

Activate
Have students examine the inside of their wrists. Ask:
- What do you observe under the skin?
- What do you think those blue lines are?
- Why do you think they are blue?
- What do you know about blood?

Have students share their background knowledge, and record their ideas on chart paper.

Provide each student with a copy of Activity Sheet A: Video Viewing Guide (1.6.1), and have students complete it as they watch the video “Exploring the Heart: The Circulatory System” at <https://www.youtube.com/watch?v=-s5iCoCaofc>.

After watching the video, have students share their new knowledge in a class discussion.

Introduce the guided inquiry question: Why is healthy blood red?

Activity Sheet A
Directions to students:
As you watch the video, complete the activity sheet by recording new vocabulary, drawing labelled diagrams of images you see, describing the main idea and some interesting facts mentioned, and noting any new questions you have after watching it (1.6.1).

Action: Part One
Display the Diagram: The Circulatory System (1.6.2). Review what students already know about this system. Ask:
- What system do you think is shown in the diagram?
- What is the circulatory system?
- What does the word circulate mean?
- What circulates in our bodies?
- What is the main body part or organ in the circulatory system?
- How does blood circulate from the heart throughout the body?

Record students' ideas on a sheet of chart paper titled “The Circulatory System.”

Action: Part Two
Have students inhale deeply and then exhale. Ask:
- What happens when you breathe in, or inhale?
- What are you inhaling? (air)
Why do you inhale air? (for the oxygen in the air)

Have students share their background knowledge, and record their ideas on chart paper.

Then, provide each student with an additional copy of Activity Sheet A: Video Viewing Guide. Have students complete the sheet as they watch the video “How the Body Works: The Respiratory System” at www.youtube.com/watch?v=RPdGQ-A_yM4.

Display the Diagram: The Respiratory System (1.6.3). Review what students already know about this system. Ask:

- What system do you think is shown in the diagram?
- What is the respiratory system?
- What does the word respire mean?
- What is the main body part or organ in the respiratory system?
- What have you learned about how the respiratory system works?

Record students’ ideas on a sheet of chart paper titled “The Respiratory System.”

**Action: Part Three**

Organize the class into working groups. Provide each group with one of the Vocabulary Cards (1.6.4) and provide each student with a copy of Activity Sheet B: The Respiratory and Circulatory Systems (1.6.5). Explain to students that each group has a vocabulary word related to the respiratory system and/or the circulatory system. Students in each group should record what they already know about their term, then find five new related facts. Model the task for students, using an example from the digestive or urinary system:

- I know the liver is important for digesting fat.
- I know the liver helps to remove harmful poisons from the body.
- I know the liver stores blood sugar.
- I learned the liver stores vitamins A, D, E, K, and B12.
- I learned the liver keeps the body at a constant temperature by warming the blood as it passes through the liver.

Provide the groups with a variety of reference materials about the respiratory and circulatory systems, and give them plenty of time to access the information.

Later, have groups report back to the class to explain what they have learned about their term.

**Activity Sheet B**

Directions to students:

Use the activity sheet to record information you already know about the term you are researching, as well as new information that you find about the term (1.6.5).

**Action: Part Four**

In a large space (e.g., gym, playground) set up a model of the circulatory and respiratory systems using three long pieces of rope (each piece about 3 m long), four pails, red balls, blue balls, four pylons, sticky notes, and markers.

On the floor of a large space, form a piece of rope into a heart-symbol shape. Use a sticky note to label it as the heart.

**NOTE:** This is an opportunity to discuss with students the difference between the heart as a symbol and the heart as an organ. It is important that students know that the symbol does not represent the appearance of the organ.

Use another piece of rope to represent the lungs and another sticky note to label them.
Place two large pails inside the “lungs.” Fill one pail with red balls, and leave the other pail empty.

Use the third piece of rope to represent the body tissues and organs, and label with a sticky note. Place two pails inside this rope. Fill one pail with blue balls, and leave the other pail empty.

Place two pylons halfway between the “lungs” and the “body tissues and organs.” Label one pylon “veins” and the other pylon “arteries.”

Place two pylons between the lungs and the heart. Label one pylon “pulmonary vein” and the other pylon “pulmonary artery.”

Have each student pick up a red ball, which represents oxygenated blood cells, from the lungs station (pail), move to the heart via the pulmonary vein, then down to the body tissues and organs via the arteries. As students move, have them bounce the balls to represent the blood pumping and flowing through the body. This part of the circuit shows the movement of oxygenated blood from the lungs, along the pulmonary vein to the heart, then along arteries to tissues and organs.

At the body tissues and organs station, have students exchange red balls for blue balls, which represent the body’s use of the oxygen in the blood. Then, have students move back toward the heart along veins, and to the lungs along the pulmonary artery. At this point, have them exchange blue balls for red balls, which represent the blood oxygenated at the lungs. Explain that blood is red because of the hemoglobin it contains, to which the oxygen binds.

Then, ask students to repeat the cycle.

Have students discuss the process as they conduct this activity. Encourage them to focus on the path blood takes, as well as on the oxygenation of blood and use of this oxygenated blood.

**Consolidate and Debrief**

- Revisit the guided inquiry question: **Why is healthy blood red?** Have students share their knowledge, provide examples, and ask further inquiry questions.
- Have students add to the KWHL chart as they learn new concepts, answer some of their own inquiry questions, and ask new inquiry questions.
- Add new vocabulary and illustrations to the word wall. Add the words in languages other than English, as appropriate.
Have students add new vocabulary, illustrations, and sentences to their Science and Technology Glossary (1.1.1). When possible, encourage students to add the words in languages other than English, including Indigenous languages, reflective of the classroom community.

Assessment as Learning
Have students complete copies of the Student Self-Assessment sheet, on page 32, to reflect on their learning about the circulatory and respiratory systems.

Enhance

Make additional vocabulary cards with new terms for students to research (e.g., alveoli, oxygenate, atrium, ventricle, capillaries, and nutrients).

Organize the class into two or three groups (depending on class size and/or number of words chosen for review). Give each group a set of Vocabulary Cards (1.6.4), and have students string all the cards into a continuous description of the system(s). Model this process for students, using the digestive system as an example:

- Teacher: Food enters the body through the mouth.
- Student: The teeth chew the food.
- Student: Saliva moistens the food.
- Teacher: Digestion begins in the mouth, where enzymes in the saliva begin breaking down the food.
- Student: The food moves down the esophagus.

Have students use the vocabulary cards to create a word cycle for a review of the terminology, as in the Sample: Word Cycle (1.6.6).

Have students continue working on their do-it-yourself projects at the Makerspace centre.
# Video Viewing Guide

Name of video: ____________________________________________

<table>
<thead>
<tr>
<th>New terms:</th>
<th>Diagrams:</th>
<th>Main idea:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interesting facts:</th>
<th>New questions I have:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Circulatory System

carotid artery
jugular vein
heart
renal vein
pulmonary artery
aorta artery

Legend:
- veins
- arteries
The Respiratory System

- nasal cavity
- trachea
- bronchioles
- lungs
<table>
<thead>
<tr>
<th>respiratory system</th>
<th>nose</th>
</tr>
</thead>
<tbody>
<tr>
<td>trachea</td>
<td>lungs</td>
</tr>
<tr>
<td>oxygen</td>
<td>carbon dioxide</td>
</tr>
</tbody>
</table>
Vocabulary Cards (continued)

- circulatory system
- heart
- blood
- blood vessels
- veins
- arteries
The Respiratory and Circulatory Systems

Let’s find out about the ________________________________.

Things we know already:
1. __________________________________________________
2. __________________________________________________
3. __________________________________________________
4. __________________________________________________

Interesting facts we learned:
1. __________________________________________________
2. __________________________________________________
3. __________________________________________________
4. __________________________________________________

Diagram:


Resources we used: ___________________________________________

___________________________________________________________

One new question I have about these body systems: ________________

___________________________________________________________
Word Cycle

The circulatory system begins at the heart. Blood is pumped through the arteries to all parts of the body. Oxygen is picked up at the lungs and carried through the veins back to the heart. Carbon dioxide is released through the trachea and breathed out through the nose. This cycle continues indefinitely.
References


Ontario Science Centre. Inquiry-Based Learning Video Series. <https://www.youtube.com/playlist?list=PLWJ3p5pi7LDEIs45dP4MCQfT-xWMf1f59q>


Appendix

Images in this appendix are for the Image Banks referenced in the lessons. Corresponding full-page, high-resolution images can be printed or projected for the related lessons, and are found on the Portage & Main Press website.
Unit 1: Human Organ Systems

Lesson 2: Why Does What We Eat Matter?

Traditional Indigenous Foods

1. Strawberries
2. Blackberries
3. Blueberries
4. Raspberries
5. Collecting Maple Sap in Late Winter
6. Maple Syrup
7. Squash
8. Roasted Squash
9. Hickory Nuts
10. Bannock
11. Wild Rice in Lake
12. Wild Rice
13. Eastern Cottontail
14. Snowshoe Hare
15. Elk
16. White-tailed Deer
17. Venison
18. Bull Moose
19. Beaver
20. Black Bear
21. Mallards
22. Duck, Ready to Roast
23. Canada Geese
24. Cooking Geese and Bannock
25. Ptarmigan

26. Wild Turkeys

27. Cooked Turkey

28. Spruce Grouse

29. Roasted Grouse

30. Rainbow Trout Yearling

31. Barbecuing Trout

32. Muskellunge

33. Juvenile Northern Pike

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9 – Hickory Nuts by Ivy Dawned. Used under CC BY-SA 2.0 licence.
10 – Bannock by Nicholas. Used under CC BY 2.0 licence.
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19 – Beaver by USFWSmidwest. Used under CC BY 2.0 licence.
20 – IMG_8774-114.jpg by David Mitchell. Used under CC BY 2.0 licence.
21 – Ducks by Martin Cooper. Used under CC BY 2.0 licence.
22 – Duck, Ready to Roast by Tim Sackton. Used under CC BY-SA 2.0 licence.
23 – Canada Geese by Kevin M Klerks. Used under CC BY 2.0 licence.
24 – Cooking Geese and Bannock in a Smoke House by Sandra Cohen-Rose and Colin Rose. Used under CC BY-SA 2.0 licence.
Lesson 3: What Happens to Food After We Eat It?
The Digestive System

1. Diagram - The Digestive System

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Lesson 4: Why Is Water Important for a Healthy Body?
The Urinary System

1. Diagram - The Urinary System

Image Credits:
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Lesson 6: Why Is Healthy Blood Red?
The Circulatory and Respiratory Systems

1. Diagram - The Circulatory System
2. Diagram - The Respiratory System

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Lesson 8: How Do Healthy Joints, Bones, and Muscles Help You Move?
The Human Skeletal and Muscular Systems

1. Diagram - The Human Skeletal System
2. Diagram - The Human Muscular System

Lesson 9: How Does the Brain Send Messages to the Rest of the Body?
The Human Brain and Nervous System

1. Diagram - The Human Brain
2. Diagram - The Human Nervous System

Unit 2: Forces Acting on Structures and Mechanisms
Lesson 2: How Do Bridges Withstand Forces?
Bridges

1. Beam Bridge in Montreal Falls, Ontario
2. Arched Bridge in Packenham, Ontario
3. Cantilever Bridge Between Pointe-à-la-Croix, Quebec and Campbellton, New Brunswick

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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 continues to develop new Hands-On projects, and also serves as a School Trustee for the St. James-Assiniboia School Division in Winnipeg, Manitoba.

Brad Parolin is a junior division teacher at John A. Leslie Public School located in Scarborough, Ontario. Formerly, he was an Instructional Leader for Science and Technology with the Toronto District School Board.

Monique Pregent is an elementary science teacher in southwestern Ontario. As an Anishinaabe teacher, she is passionate about sharing how to add First Nations, Metis, and Inuit perspectives into all subjects, especially science and mathematics. She has presented in workshops with school boards and the Elementary Teachers Federation of Ontario, and been a guest writer in resources about how to infuse Indigenous perspective into all subjects. She believes more perspective needs to be added to all other aspects of education as well, and welcomes the day when it becomes a normal practice.

Kevin Reed is the Indigenous Education Consultant for the Limestone District School Board in Kingston, Ontario. He is the author of Aboriginal Peoples: Building for the Future and co-author of Aboriginal Peoples in Canada. He received a Prime Minister’s Award for Teaching Excellence in 2008. He is a member of the Nacho Nyak Dun First Nation.