



Science: Grade 4

ENGLISH Program

Discipline Overview


Science is systematic exploration, observation, experimentation, and evidence-based reasoning used to build an understanding of the natural world. It emerges from human curiosity and employs creativity, imagination, and intuition to uncover new knowledge.

Science comprises an established body of knowledge and provides a philosophical framework for generating new insight into the natural world. Science is shaped by historical, political, economic, environmental, and societal factors, which are integral to understanding its significance as a valuable human endeavour.

Science is foundational for understanding natural phenomena, solving problems, and developing new technology. Through the study of science, learners become scientifically literate; they expand their knowledge, develop critical thinking and data analysis skills, and learn to evaluate procedures effectively. Scientific literacy equips learners to critically engage with information, make informed decisions, and address complex issues on both personal and societal levels. Science education fosters responsible citizenship, nurtures curiosity, and encourages interdisciplinary thinking through connections with mathematics, engineering, arts, languages, physical health, and the social sciences.

In Manitoba, Kindergarten to Grade 10 science education rests on the following five strands:

- **Indigenous Peoples within the Natural World:** Indigenous Peoples—First Nations, Métis, and Inuit—have always engaged in scientific ways of knowing, being, and doing. All learners of science benefit from developing an understanding of how different Indigenous communities interpret the natural world, apply scientific principles, and create technologies in interrelated and sustainable ways.
- **Science Identity:** Throughout history, people from diverse backgrounds have played roles in the development of science, and all people, societies, and environments are affected by science and technology. All learners must be empowered to see themselves as participants in the collective scientific endeavour.
- **Practical Science:** This strand includes STSE (science, technology, society, and environment) contexts, measurement, actions and practices, scientific instruments, and the awareness of science application in careers, hobbies, and activities. All learners must be equipped with scientific skills and attitudes to take action for the betterment of society and for a sustainable future.

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- **Nature of Science:** This strand includes the purpose, methods, applications, and implications of scientific inquiry. All learners must develop the scientific confidence needed to navigate the complexities of an information-rich environment, including differentiating between legitimate scientific information, pseudoscience, misinformation, and disinformation.
 - **Scientific Knowledge:** This strand includes information, concepts, principles, theories, and facts that have been acquired, tested, and validated through the systematic process of scientific inquiry. All learners must acquire a fundamental core knowledge base to become scientifically literate citizens.

Scientific Knowledge and Nature of Science learning outcomes are organized around building an understanding of 14 big ideas* in and about science. Ten big ideas in science are addressed via Scientific Knowledge learning outcomes that are unique to every grade level, while four big ideas about science are investigated through the Nature of Science strand in four progressive grade bands. The contribution of different First Nations, Inuit, and Métis groups are studied in the Indigenous Peoples within the Natural World strand, while connecting all learners to science inclusively is addressed in the Science Identity strand. The Practical Science learning outcomes emphasize that science is active and participatory.

These intertwined strands of learning outcomes put learners on a pathway of increasing scientific literacy. Learners develop their global competencies, which allow them to engage authentically with the curriculum and build enduring understandings of science.

Course Overview

In **Grade 4**, learners continue to explore science and build science literacy in more sophisticated ways. They use their expanding scientific skills to investigate light and sound, find evidence of energy, examine soil, and look at ecosystems. The knowledge areas of **fields, energy, Earth science, and life systems** provide a foundation for study. An active and practical approach to learning and doing science continues in Grade 4. This includes conducting scientific investigations, expanding tool and measurement skills, exploring science in everyday life, and examining how science interacts with society and the environment. Learners develop their agency and sense of belonging in science, and explore Indigenous ways of knowing, being, and doing, including through interacting with the local community and learning in nature. The Grades 3 to 6 Nature of Science learning outcomes continue with **purpose, methods, applications, and implications** of science.

Inquiry questions to help guide learning and planning for the year may include the following:

- How is energy detected, stored, and used?
- How does energy move through ecosystems?
- How is soil formed and what is its role in the environment?

Please see documents in the [curriculum implementation resources](#) section for more information on how to use this curriculum.

* Harlen, Wynne, editor. *Working with Big Ideas of Science Education*. Science Education Program (SEP) of IAP (InterAcademy Partnership), 2015. Available online at <https://www.interacademies.org/publication/working-big-ideas-science-education>.

Global Competencies in Science



Critical Thinking

Critical thinking in science involves using evidence based on observation, experience, and experimentation to test ideas, solve problems, and deepen scientific knowledge; critical thinking is an essential aspect of scientific inquiry. Critical thinkers use various processes and wide sources of evidence to distinguish accurate and reliable information from biased information or misinformation. Thinking critically leads to the discovery of relationships within and among various phenomena. Through scientific critical thinking, theories are formed and tested; they are reinforced, challenged, shifted, or abandoned.

When critical thinking as a competency is applied in science, learners

- use strategic, efficient, and effective research skills to find and use reliable sources
- display scientifically valid skepticism when evaluating sources of information for bias, reliability, and relevance
- observe, test, and experiment to explore and connect ideas, patterns, and relationships, using scientific criteria and evidence
- reflect on a position from multiple scientific perspectives and defend, adjust, or change position based on scientific evidence and feedback from peers
- are willing to ask scientifically relevant questions to further their understanding
- make judgments based on the best available scientific evidence, observations, and experiences
- weigh criteria to make ethical scientific decisions when their actions may affect themselves, others, living things, or the environment



Creativity

Creativity in science drives the exploration of scientific ideas, processes, problems, and issues. Science is a deeply creative process aimed at generating new ideas, designing innovative products and processes, and producing evidence to support well-informed decision-making. Scientific thinkers use imagination and evidence to build theories and models that explain phenomena in the physical world, and they design experiments to test those theories. This process may lead to shifts in human understanding and to new technologies.

When creativity as a competency is applied in science, learners

- demonstrate initiative, open-mindedness, inventiveness, flexibility, and a willingness to take prudent risks
- demonstrate curiosity about the natural world, ask scientifically relevant questions, and are comfortable playing with ideas

- employ scientific strategies to solve problems by applying knowledge and ideas in innovative ways
- deepen their understanding of scientific concepts by building on the ideas of their peers and endeavouring to see the world through a variety of lenses
- create plans and adjust them as needed in product design or to experimentally investigate a problem
- test and adapt plans used during inquiry, design, or decision-making processes, and persevere through obstacles to improve



Citizenship

Citizenship in science involves a recognition and an understanding of the consequences of scientific decisions and practices on oneself, others, and the natural world. Scientific approaches to knowledge acquisition recognize the fallibility of human faculties, including natural human biases and the limitations of perception. Citizenship in science involves participating in a process of peer review and acknowledging the breadth and depth of people and cultures that contribute to understanding the physical world. The world's accumulated scientific knowledge serves to help sustain the world. It should be ethically gathered, willingly shared, and passed from generation to generation.

When citizenship as a competency is applied in science, learners

- understand that science often deals with complex issues, on which varying perspectives may exist
- explore the interconnectedness of self, others, and the natural world
- evaluate factors and propose scientifically valid solutions considerate of the well-being of self, others, and the natural world
- welcome diverse scientific viewpoints because they understand that contributions to science come from those with varied backgrounds, experiences, and world views
- are respectful of their peers' perspectives, including those that do not fit their own
- communicate with their science community in responsible, respectful, and inclusive ways
- contribute to the betterment of community both near and far, in doing scientific investigations
- seek equitable solutions to scientific issues that support diversity, inclusivity, and human rights
- make ethical decisions based on evidence, which have a positive and sustainable impact on self, others, and the natural world



Connection to Self

Connection to self in science involves learners developing confidence in their abilities in science and a positive relationship to science. Scientific thinking is a skill that can be developed, and it has valuable applications to daily life. The practice of science involves prudent risk taking, exercising curiosity, analytical evaluation of beliefs, and a willingness to grow and change based on verifiable information. Engaging in scientific practice teaches individual resiliency and perseverance, and promotes an understanding of one's place in the natural world.

When connection to self as a competency is applied in science, learners

- acknowledge their personal interests, strengths, gifts, and challenges in making connections between science and their lives
- come to know factors that shape their scientific identity and to understand that everyone is a scientist
- understand and use strategies to support self-regulation during scientific investigations and when receiving peer feedback
- reflect on their scientific decisions, effort, and experience, and accept that acknowledging feedback from others is part of the scientific process
- set goals to strengthen their scientific learning progress and well-being, as part of the scientific process
- recognize that a scientific understanding of the natural world can instill hope and optimism about the future
- are resilient and persevere through obstacles, recognizing that they will learn from mistakes and build upon their successes
- demonstrate the ability to critically evaluate their own ideas and beliefs, and are open-minded to adapt and change in response to new evidence
- value their own voice, build their confidence, and embrace their role as lifelong science learners



Collaboration

Collaboration in science involves learning with and from others to develop scientific ideas and processes. The process of peer review and the seeking of expert consensus are valued practices in the scientific endeavour. The advancement of science often occurs through collaboration among scientists and teams of scientists.

When collaboration as a competency is applied in science, learners

- seek to understand diverse perspectives, voices, and ideas, seeing these as integral components of the scientific process
- understand that in science, new ideas often build upon the contributions and ideas of others

- value the scientific contributions of others
- participate in the process of asking scientific questions of themselves and others and actively listening to responses
- contribute by working through differences, and show a willingness to compromise or change perspective in response to scientific evidence, as participating members of scientific teams
- collaboratively gather and interpret empirical data, striving for a shared understanding of its scientific meaning
- commit to their role as part of a team with a collective purpose toward a common goal in inquiry, design, and decision-making processes



Communication

Communication in science involves interaction with others to share scientific ideas and information in diverse contexts. The clear communication of scientific information is a vital part of the scientific endeavour. What is communicated as scientific knowledge must be credible, open to interrogation by experts, testable, and verifiable. Scientific communication often conveys information in mathematical, graphical, and technical formats, and must acknowledge the limitations and uncertainties inherent in quantitative empirical investigations. The language and symbols within narrow fields often become extremely specialized. Communication among fields, and from scientific communities to the public, often requires interpretation by teachers, journalists, and other science communicators.

When communication as a competency is applied in science, learners

- express ideas and organize information, including uncertainty and error, clearly and succinctly using appropriate scientific terminology and representations
- use multiple modes and forms of communication, which take into account purpose, context, and audience, to share scientific ideas
- understand how their words and actions shape their identity, whether in person or online
- use their scientific background and context cues to enhance understanding of scientific communications
- seek to understand the scientific perspective of their peers through active listening and questioning
- deepen their understanding of scientific ideas by making connections and building relationship through conversation, discussion, and interaction in a variety of contexts and through varied media
- advocate for themselves and others in constructive and responsible ways to strengthen their scientific community



Enduring Understandings

Science is about explaining phenomena.

Science explains the cause or causes of phenomena observed in the natural world using various scientific practices.

Science is a collective endeavour.

Science is a collective human endeavour that discovers laws, builds models, and formulates theories that best fit the empirical evidence available at a particular time.

Science is interconnected with technology.

In science, there is a symbiotic relationship between scientific understandings and technological developments for the solution of problems.

Science has complex implications.

Science and its applications have ethical, social, personal, economic, political, cultural, and environmental implications, such as considerations of sustainability and social justice.

Science empowers human agency.

Science fosters curiosity that supports the development of a science identity, a lifelong interest in science, and the ability to make informed decisions and have agency in everyday life.

Learning Outcomes

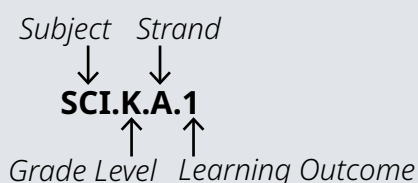
Science learning outcomes are organized into five strands. These strands and learning outcomes are intended to be woven together throughout all learning experiences while supporting the development of [global competencies](#). All strands equally and cohesively build scientific literacy, skills, and attitudes, inclusive of Indigenous ways and knowledge. Teachers can tailor curriculum implementation to the learners' specific interests and needs.

Legend

Include the following = compulsory content

Examples/e.g., = suggestions for learning

Learning Outcome Key



Strand A: Indigenous Peoples within the Natural World



- SCI.4.A.1** Demonstrate an understanding of different First Nations, Métis, and Inuit ways of knowing, being, and doing in relationship with the land and the natural world by exploring Indigenous methods of observing and interpreting the world, applying scientific principles, and creating technologies within local traditional and contemporary cultural contexts (e.g., wholistic, reciprocal, interconnected, and sustainable ways; land-based learning; outdoor learning; intersections with Western science).

Strand B: Science Identity



- SCI.4.B.1** Develop a sense of agency, identity, and belonging in science by
- cultivating natural curiosity about the world
 - acquiring scientific skills and fostering scientific attitudes
 - building a personal connection to nature
 - establishing links between science concepts and personal experience
 - recognizing that everyone can contribute to science

Strand C: Practical Science



Science, Technology, Society, and Environment (STSE) Contexts

SCI.4.C.1 Demonstrate an awareness of the dynamic interplay between science, technology, society, and the environment (STSE), thereby being empowered to critically evaluate the impacts of scientific and technological advancements on individuals, communities, and ecosystems, and to make informed decisions for a sustainable future.

Examples:

producing, recording, and transmitting sound; light sources and light pollution; production and consumption of energy by humans; advantages and disadvantages of various sources of energy; energy production in Manitoba and globally; soil types and distribution in Manitoba and globally; soil erosion and mitigation measures; Indigenous uses of rocks and minerals; conservation and protection of land, water, and ecosystems; teachings related to the land in Indigenous communities; sustainable resource management; local and global biodiversity hotspots; wildlife-human interactions and coexistence; urban ecosystems; sustainable agricultural practices

Scientific Measurement

SCI.4.C.2 Demonstrate an understanding of units, measuring tools, and the nature of measurement in science. (**Bold** indicates items introduced for the first time at this grade level.)

Include the following:

- Tools: clock, thermometer, ruler, pan balance, balance, volumetric vessels
- Attributes: length, mass, volume, time, temperature, **speed**
- Units: length (km, m, cm, mm), mass (kg, g), volume (L, mL), time (h, min, s), temperature (°C), **speed (km/h, m/s)**
- Skills: measure and estimate using standard SI tools and units, **select measurement tools, display data, recognize importance of standard units, convert between basic SI length and time units**

Action and Practice

SCI.4.C.3 Demonstrate practical scientific skills through safely and actively participating in a variety of scientific practices such as inquiry-based learning experiences, experimentation, scientific observation, data analysis, measurement, debate and scientific argumentation, communicating scientific information, and designing and building.



Examples:

- Participate in learning experiences that include an Indigenous community member (e.g., Elder, Knowledge Holder, Knowledge Keeper) to share knowledge, experience, or teachings related to the curriculum.
- Make observations to provide evidence that energy can be transferred from place to place by sound and light.
- Examine physical characteristics of soils (e.g., particle size, texture, moisture, distribution, colour, and ability to hold together) from different locations in the local environment (e.g., garden, flowerpot, riverbed and bank, marsh, hilltop, grassy field, lawn, ditch, forest).
- Construct a visual representation of a specific food chain that exists within a habitat or community.
- Use tools and apparatus in a manner that ensures personal safety and the safety of others.

Scientific Instruments

SCI.4.C.4 Demonstrate an understanding of the purpose and functioning of various scientific instruments and materials (considering availability and appropriateness), as well as competence in using them safely.

Examples:

magnifying glass, binoculars, prism, tuning fork, light source, craft and recycled materials, classroom materials, materials from nature, labelled diagrams, charts, safety procedures

Careers, Hobbies, and Activities

SCI.4.C.5 Demonstrate an understanding of the connections between the scientific ideas studied and a range of careers, hobbies, and activities.

Examples:

optometrist, ophthalmologist, audiologist, sound engineer, musician, teacher, materials transportation, agronomist, farmer, ecologist, hydro worker, geologist, DJing, gardening, Indigenous teachings related to life interconnectedness, making art, playing an instrument, table tennis, outdoor play and learning



Strand D: Nature of Science (Grades 3 to 6 Band)



Purpose: Science is about finding the cause or causes of phenomena in the natural world.

SCI.4.D.1 Demonstrate the understanding that science attempts to develop explanations for phenomena in nature.

Method: Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.

SCI.4.D.2 Demonstrate the understanding that developing scientific explanations involves systematically collecting data through observations and measurements or using data from other sources.

SCI.4.D.3 Demonstrate the understanding that a hypothesis is a prediction about what is happening, or what might happen, based upon theory, research, past experience, observations, or other evidence.

SCI.4.D.4 Demonstrate the understanding that the data that scientists look for is guided by a theory or a hypothesis, and the evidence they find supports or refutes their predictions.

Application: The knowledge produced by science is used in engineering and technologies to create products or processes.

SCI.4.D.5 Demonstrate the understanding that engineering is the application of scientific principles and approaches to solving problems, often resulting in new technology that furthers scientific discovery.

SCI.4.D.6 Demonstrate the understanding that when solving problems, there may be many possible solutions, each with associated implications, requiring both critical and creative thinking in choosing the best solution.

Examples: functionality, sustainability, economic considerations, ethics, impacts on all living things and all parts of the ecosystems

Implication: Applications of science often have ethical, environmental, social, economic, and political implications.

SCI.4.D.7 Demonstrate the understanding that technologies may have both beneficial and detrimental social and environmental consequences.

Strand E: Scientific Knowledge




Fields: Objects can affect other objects at a distance.

- SCI.4.E.1** Demonstrate the understanding that light and sound are examples of energy that transmits from a source and that can cause effects on objects at a distance.
Examples: light transmitting to the eye, sound transmitting to the ear, heat transmitting from an element
- SCI.4.E.2** Demonstrate the understanding that light and sound transmissions can interact in various ways with matter.
Examples: reflection, absorption, transmission, scattering
- SCI.4.E.3** Demonstrate the understanding that sound is created by an energized source and is transmitted in all directions as vibrations in air (or other material) to the ears.
Include the following: sense, vibrating source, ear, ear drum, loudness, pitch.
- SCI.4.E.4** Demonstrate the understanding that light is emitted in all directions by an energized source, and transmits through empty space or transparent matter to the eyes.
Include the following: sense, light source, eye, retina.
- SCI.4.E.5** Demonstrate the understanding that visible objects either emit light or reflect light into the eye.
Include the following: luminous, illuminated, source, reflection, light source.

Energy: The total amount of energy in the universe is always the same but can be transferred from one energy store to another during an event.

- SCI.4.E.6** Demonstrate the understanding that energy can transfer from a source (e.g., Sun, fuel, motor, electrical outlet) to objects or organisms to cause actions (e.g., living, heating, moving, charging).
- SCI.4.E.7** Demonstrate an understanding of the varied ways that humans use senses to detect energy in action.
Examples: heat (touch), light (sight), sound (hearing), electrical devices (various), combustion (various), observing motion
- SCI.4.E.8** Demonstrate an understanding of the differences among renewable and non-renewable energy sources.
Include the following: hydroelectric, fossil fuels, nuclear, wood, wind, solar.



Earth Science: The composition of Earth and its atmosphere and the processes occurring within them shape Earth's surface and its climate.

- SCI.4.E.9** Demonstrate an understanding of the nature and types of soil.
Examples: sandy, silty, loamy, clay
- SCI.4.E.10** Demonstrate an understanding of the properties of fertile soil.
Include the following: air, water, nutrients, worms, insects, microbes, organic matter.
- SCI.4.E.11** Demonstrate an understanding of the types of rock, rock formation, and geographic location of rock types.
Include the following: igneous, sedimentary, metamorphic.
- SCI.4.E.12** Demonstrate an understanding of weathering and the erosion of rock, and its relation to soil formation.
Include the following: bedrock, boulders, gravel, sand, silt, clay.

Life Systems: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.

- SCI.4.E.13** Demonstrate the understanding that every living thing has adapted to survive in a specific habitat.
Examples: food, water, climate, camouflage, survival strategies, shelter
- SCI.4.E.14** Demonstrate an understanding of the cycling of matter and flow of energy among living and non-living parts of an ecosystem.
Include the following: food chains, food webs.
- SCI.4.E.15** Demonstrate an understanding of how plants and animals (including humans) rely on each other and the environment for survival.
Include the following: soil nutrients, water, food, shelter, fuel, clothing, pollination, seed dispersal.

Curriculum Implementation Resources

Curriculum implementation resources will include supplementary documents to support implementation. This section and the support documents will continue to be updated, so you are encouraged to visit the site regularly.