

# Science: Grade 5 Pilot

## ENGLISH Program

### Discipline Overview


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

Science contains a body of established 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 endeavor.

In Manitoba, the K–10 Science education rests on the following five dimensions:

- **Indigenous People within the Natural World** – First Nations, Métis, and Inuit have always engaged in scientific ways of knowing, doing and being; all learners of science benefit from developing an understanding of how different Indigenous communities interpret the natural world, apply scientific principles, and create technologies in interrelated and sustainable ways.
- **Science Identity** – Throughout history, peoples from diverse backgrounds have played roles in the development of science and all people, societies, and environments are affected by science and technology; all learners must be empowered to see themselves as participants in the collective scientific endeavour.
- **Scientific Knowledge** – Information, concepts, principles, theories, and facts that have been acquired, tested, and validated through the systematic process of scientific inquiry; all learners must acquire a fundamental core knowledge base to become scientifically literate citizens.
- **Practical Science** – STSE (Science, Technology, Society, and Environment) contexts, measurement, actions and practices, scientific instruments and 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 a sustainable future.
- **Nature of Science** – The purpose, methods, applications, and implications of scientific inquiry; all learners must develop the scientific confidence to navigate the complexities of an information rich environment, including differentiating between legitimate scientific information, pseudoscience, misinformation, and disinformation.

These intertwined dimensions, within which rest a structure of curricular outcomes, put learners on a continuous pathway of increasing scientific literacy. Learners develop their global competencies, which in turn allow them to engage authentically with the curriculum and build enduring understandings of science.



Science is foundational for understanding natural phenomena, solving problems, and in the development of 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 not only fosters responsible citizenship but also nurtures curiosity and encourages interdisciplinary thinking through connections with mathematics, engineering, arts, languages, physical health, and the social sciences.

## Course Overview

The Manitoba K-10 science curriculum is constructed with five categories of learning outcomes: Indigenous Peoples within the Natural world, Science Identity, Scientific Knowledge, Practical Science and Nature of Science. Scientific Knowledge and Nature of Science outcomes are organized around building an understanding of fourteen Big Ideas<sup>1</sup> in and about science. Ten Big Ideas in science are addressed via Scientific Knowledge outcomes which are unique to every grade level, while four Big Ideas about science are investigated through the Nature of Science category 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 category, while connecting all students to science inclusively is addressed in the Science Identity category. The Practical Science outcomes emphasize that science is active and participatory.

In **Grade 5**, learners continue to study science and build science literacy in increasingly sophisticated ways. They use their expanding scientific skills to investigate physical and chemical change, explore simple machines, look at weather and climate, and learn about cells. The knowledge areas of **matter, force, Earth science** and **life science** provide a foundation for study. Promoting an active and practical approach to learning and doing science continues to advance in Grade 5. This includes conducting scientific investigations, furthering tool, and measurement skills, exploring science in everyday life, and examining how science interacts with society and the environment. Learners continue to develop their agency and sense of belonging in science. In Grade 5, they have many opportunities to explore Indigenous ways of knowing, being and doing, including through interacting with local community and land-based learning. The Grades 3–6 band nature of science outcomes continues and includes the **purpose, methods, applications, and implications** of science. Suggested guiding inquiry questions for the year are:

- How do chemical and physical systems work?
- How do weather and climate systems work?
- How do life systems work?

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

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<sup>1</sup> See BISE document.

# Global Competencies in Science



## Critical Thinking

**Critical thinking in science** involves using empirical evidence 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 good information from bad. Thinking critically leads to the discovery of relationships within and between various phenomena. Through scientific critical thinking, theories are formed and tested; they are reinforced, challenged, shifted, or abandoned.

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 judgements 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** involves the exploration of scientific ideas, processes, problems, and issues. Science is a creative process with the goals of generating new ideas, products, processes and producing evidence for well-informed decision making. Scientific thinkers use the best available evidence to build theories to explain phenomena in the physical world, and they create experiments to test those theories. This process may lead to shifts in human understanding, and to new technologies.

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



## Citizenship

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**Citizenship in science** involves a recognition and 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 the limitations of perception and natural human biases. Citizenship in science involves participating in a process of peer review and acknowledging that people from all cultures and backgrounds have contributed understandings of the physical world. The world's accumulated scientific knowledge serves to help sustain and better humanity and the environment; it should be ethically gathered, willingly shared, and passed from generation to generation.

### 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, even those that do not fit their own.
- communicate with their science community in a 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 which 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

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**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 which can be learned, and which 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, perseverance, and promotes an understanding of one's place in the natural world.

### 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 to new evidence.
- value their own voice, build their confidence and embrace their role as life-long science learners.



## Collaboration

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**Collaboration in science** involves learning with and from others to elaborate 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 amongst scientists and teams of scientists.

### 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 towards a common goal in inquiry, design, and decision-making processes.



## Communication

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**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 endeavor. 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 becomes extremely specialized. Communication between fields, and from scientific communities to the public, often requires interpretation by teachers, journalists, and other science communicators.

### Learners

- express ideas and organize information clearly and succinctly using appropriate scientific terminology and representations, including uncertainty and error.
- use multiples modes and forms of communication to share scientific ideas, which account for purpose, context, and audience.
- understand how their words and actions shape their identity both in person and 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 in K to 12 Science

### **Science is about explaining phenomena.**

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

### **Science is a collective endeavour.**

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

### **Science is interconnected with technology.**

Science 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, ethics, or social justice.

### **Science empowers human agency.**

Science fosters curiosity and develops a science identity which supports a lifelong interest and informs decision making and agency in everyday life.



## Learning Outcomes

### Indigenous Peoples within the Natural World Outcome

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- SCI.5.INW.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, intersections with Western science, etc.).

### Science Identity Outcome

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- SCI.5.SI.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.

### Practical Science Outcomes

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

- SCI.5.PS.1** Demonstrate an awareness of the dynamic interplay between science, technology, society, and the environment (STSE), empowering learners to critically evaluate the impacts of scientific and technological advancements on individuals, communities, and ecosystems, and to make informed decision for a sustainable future.

Examples:

chemical products in everyday life; simple machines and modern and traditional technologies; traditional indigenous tools; human and environmental consequences of weather phenomena; water pollution and conservation; human activities and climate change; conservation and protection of water; indigenous traditional teachings related to water; healthy life choices; etc.





## Scientific Measurement

**SCI.5.PS.2** Demonstrate an understanding of the units, measuring tools, and nature of measurement in science\*.

Include:

Tools: thermometer, ruler, pan balance, balance, volumetric vessels, **spring scale**, **anemometer**

Attributes: length, weight, volume, time, temperature, speed, **force**

Units: length (km, m, cm, mm), weight (g, kg), volume (L, mL), time (h, min, s), temperature (°C), speed (km/h, m/s), **force (N)**

Skills: Measure and estimate using standard SI tools and units, select measurement tools, display **quantitative data (charts, line graphs, tables, etc.)**, recognize importance of standard units, convert between SI length, time, and **volume** units


\* **Bold** indicates items introduced for the first time at this grade level

## Action and Practice

**SCI.5.PS.3** Demonstrate practical scientific skills through safely and actively participating in a variety of scientific practices such as inquiry-based learning experiences, experimentation, scientific observation, data analysis, measurement, debate, communicating scientific information, design and build, etc.

Examples:

- Invite an Elder or a Knowledge Keeper to share Indigenous Teachings.
- Observe examples of changes in substances, classify them as physical or chemical changes, and justify the designation. (Examples: physical — bending a nail, chopping wood, chewing food; chemical — rusting of a nail, burning wood, cooking food, etc.)
- Use the design process to construct a prototype containing a system of two or more different simple machines that move in a controlled way to perform a specific function.
- Research effects of short- and long-term changes in weather on the lives and livelihoods of people locally, nationally, and globally.
- Design and carry out procedures, including identifying and controlling variables, to investigate the structure and/or function of one or more body systems (e.g., the influence of exercise on heart rate, the role of simulated saliva in starting the digestion process, and factors that influence a person's response time).
- Use tools and materials in a manner that ensures personal safety and the safety of others (e.g., keeping an uncluttered workspace; putting equipment away after its uses; handling glassware with care).
- Etc.



## Scientific Instruments

**SCI.5.PS.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:

glassware, chemical substances, microscope, craft and recycled materials, classroom materials, nature materials, logbook, diagrams, charts, graphs, spreadsheets, safety procedures, etc.

## Careers, Hobbies and Activities

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

Examples:

physicist, engineer, mechanic, machinist, firefighter, climate scientist, teacher, doctor, wildlife expert, pool maintenance, nutritionist, DIY hobbies, maintaining equipment, gardening, traditional and seasonal planting and harvesting, cooking, and baking, maintaining a home, track and field, swimming, etc.

## Nature of Science Outcomes

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


**SCI.5.NOS.1** Demonstrate an understanding that science is an attempt 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.5.NOS.2** Demonstrate an understanding that developing scientific explanations involves systematically collecting data through observations and measurements or using data from other sources.

**SCI.5.NOS.3** Demonstrate an 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.5.NOS.4** Demonstrate an understanding that the data scientists look for is guided by a theory or a hypothesis, and the evidence that they find supports or refutes their predictions.



**Application:** The knowledge produced by science is used in engineering and technologies to create products to serve human ends.

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

**SCI.5.NOS.6** Demonstrate an understanding that when solving problems, there are often many possible solutions, each with associated implications, requiring both critical and creative thinking in choosing the best solution.

Examples: functionality, sustainability, economic considerations, human effects, ethics, etc.

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

**SCI.5.NOS.7** Demonstrate an understanding that technologies may have both beneficial and detrimental social and environmental consequences.

## Knowledge Outcomes

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**Matter:** All matter in the Universe is made of very small particles.

**SCI.5.SK.1** Demonstrate an understanding that matter takes up space and has mass.

**SCI.5.SK.2** Demonstrate an understanding that matter changes between solid, liquid, or gas phase depending on its temperature.

Include: reversible, physical change

**SCI.5.SK.3** Demonstrate an understanding of the difference between a physical mixture, a physical change, and a chemical reaction.

Examples: separation, filtration, melting, boiling, reversible, new substance, chemical change, non-reversible, etc.

**SCI.5.SK.4** Demonstrate an understanding that no matter is gained or lost during mixing, state change, or reacting.

**Force:** Changing the movement of an object requires a net force to be acting on it.

**SCI.5.SK.5** Demonstrate an understanding that forces are pushes, pulls, or twists that act on objects and can cause or change their motion.

**SCI.5.SK.6** Demonstrate an understanding of the effects of frictional forces on the motion of objects.

**SCI.5.SK.7** Demonstrate an understanding of the types of simple machines.

Include: lever, wheel and axle, screw, pulley, wedge, inclined plane



**SCI.5.SK.8** Demonstrate an understanding of how simple machines can increase, decrease, or change the direction of applied force.

**SCI.5.SK.9** Demonstrate an understanding of how friction can cause machines to be less efficient in performing a task.

Example: resistance, heat, waste, etc.

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

**SCI.5.SK.10** Demonstrate an understanding that weather conditions change daily and are caused by complex interactions between energy from the Sun and the atmosphere, water systems, and landforms.

Include: water vapor, pressure, direction, and speed of air movement (wind)

**SCI.5.SK.11** Demonstrate an understanding of the mechanics and implications of the water cycle.

Include: role of energy, relationship to weather, relationship to living things

**SCI.5.SK.12** Demonstrate an understanding of the challenges encountered in long-term weather prediction and of the important factors' meteorologists use in making forecasts.

Include: recording data, looking for patterns

**SCI.5.SK.13** Demonstrate an understanding of climate as the long-term weather patterns in a region.

Include: aspects of various climates, natural and human processes affecting climate change

**Life Science:** Organisms are organised on a cellular basis and have a finite life span.

**SCI.5.SK.14** Demonstrate an understanding that cells are the basic unit of life.

Include: size of cell, observability only with microscope, discovery of cells

**SCI.5.SK.15** Demonstrate an understanding of the basic requirements for living cells.

Include: energy (food), water, excretion of waste

**SCI.5.SK.16** Demonstrate an understanding of the purpose of cell division.

Include: repair, replacement, growth, reproduction

**SCI.5.SK.17** Demonstrate an understanding that in multicellular organisms, cells are often specialized.

Include: tissue, organ, organ system

**SCI.5.SK.18** Demonstrate an understanding that organ systems interact to maintain a healthy body.

Examples: digestive system: obtaining energy, excretory system: removing wastes, circulatory system: transportation to and from cells, etc.



## Curriculum Implementation Resources

Curriculum implementation resources will include supplementary documents to support implementation. Feedback during the pilot phase will guide the development of the Curriculum Implementation Resources section.