GRADE 4 SCIENCE *at a glance*

This ***Grade 4 Science at a Glance*** can be used in designing, planning, and assessing student learning for the year. It can be used as a planning tool to preview the content of the Grade 4 Science curriculum.

It is organized by **clusters** and sorts learning outcomes into **big ideas**. The clusters are the context in which students develop knowledge and understanding of important ideas in science while actively engaging in science and technology practices, deepening their understanding of concepts as they experience how science is actually done.

This document can be used with the ***Grade 4 Science Curriculum Overview*** to plan clear and concise expectations for student learning. It can also be used to connect learning by making links to other subject areas.

Science PRACTICES CLUSTER 0 OUTCOMES

The **practices** of science and technological design support students in acquiring a better understanding of how scientific knowledge is produced and how solutions to practical problems are designed. Students engaging in scientific inquiry and design activities simultaneously use knowledge, skills, and attitudes which deepens their understanding of concepts and provides exposure to the many approaches that are used in science and technology.

These practices are outlined in detail in *Kindergarten to Grade 4 Science: Manitoba Curriculum Framework of Outcomes*.

SCIENTIFIC INQUIRY

- Asking Questions and Making Predictions
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Obtaining, Evaluating, and Communicating Information

DESIGN PROCESS

- Identifying and Defining Practical Problems
- Researching, Planning, and Choosing a Solution
- Constructing and Testing the Model or Prototype
- Evaluating and Optimizing the Solution

HABITATS AND COMMUNITIES

- **Habitats**
  01 02 03 04 05 07 08 14 15
- **Systems interactions among organisms**
  01 09 10 11 12 13 14 15
- **Contributions of traditional knowledge**
  01 05 17
- **Advancing understanding through technological development**
  01 06 08 16

LIGHT

- **Light as a form of energy**
  01 02 03 06
- **Properties of light**
  01 05 07 14
- **Interactions between light and materials**
  01 04 08 09 10 11 12 13 14 15 16

SOUND

- **Sound as a form of energy**
  01 02 03 05 06
- **Properties of sound**
  01 04 06 07 08 13 14
- **Function of the ear and potential harmful effects of sounds on the ear**
  01 09 10 11 12
- **Interactions between sound and materials**
  01 13 14 15 16 17 18

ROCKS, MINERALS, AND EROSION

- **Properties of rocks and minerals**
  01 02 03 04 07
- **Classification of rocks**
  01 05 06 08 4-0-6c 6d
- **Fossils and geological time**
  01 09 10
- **Processes that shape the landscape over time**
  01 11 12 13 14 15

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Curriculum Overview

REPORT CARD CATEGORIES

KNOWLEDGE AND UNDERSTANDING

Cluster 1 HABITATS AND COMMUNITIES

- Living things are suited to their habitat, a specific part of the natural environment where they can meet their specific needs. Living things respond to changes in their environment, both natural and human-induced.
  01 02 03 04 05 07 08 14 15
- Populations of living things interact among themselves in communities, which have interconnected systems of food chains and thus, a continuous flow of energy from the Sun to producers and consumers.
  01 09 10 11 12 13 14 15
- Traditional Indigenous knowledge provides reliable, evidence-based views of our understanding of interactions among plants and animal populations.
  01 05 17
- Technological developments have advanced human understanding of habitats and their populations; this knowledge of plant and animal adaptations has led to new products that mimic these adaptations.
  01 06 08 16

Cluster 2 LIGHT

- Light, whether natural or artificial (depending on the source), is a form of energy (like heat, food, and sound) that is experienced in all aspects of daily life.
  01 02 03 06
- Light has specific properties, such as travelling in a straight path, bending (refracting) when moving at an oblique angle from one transparent medium to another, and reflecting from surfaces.
  01 05 07 14
- Interactions between light and various materials produce observable effects such as the separation of white light into its component colours; bending, reflection, and absorption of light; and the casting of shadows. Understanding these interactions enables the design of materials and devices that use or emit light for a specific purpose.
  01 04 08 09 10 11 12 13 14 15 16

Cluster 3 SOUND

- Sound is a form of energy produced by vibrations and experienced in a variety of forms in all aspects of daily life.
  01 02 03 05 06
- Sound travels in waves in all directions from its source and has specific properties, such as pitch, loudness, and the ability to travel through, be absorbed by, or be reflected by some material objects.
  01 04 06 07 08 13 14
- The ear acts to receive and process sound waves within a range that is characteristic to the organism; there are potentially harmful effects from excessive exposure to high intensity sounds produced by human-designed technologies.
  01 09 10 11 12
- Interactions between sound and various materials can change its properties. Understanding these interactions enables the design of materials and devices that use or emit sound for a specific purpose.
  01 13 14 15 16 17 18

Cluster 4 ROCKS, MINERALS, AND EROSION

- Rocks are composed of minerals that have identifiable properties such as colour, hardness, and lustre, which can determine their uses.
  01 02 03 04 07
- The classification of rocks into three broad categories (sedimentary, igneous, and metamorphic) identifies the environment in which the rock formed and is important to the understanding of geological processes.
  01 05 06 08 4-0-6c 4-0-6d
- Fossilization of past life forms provides an understanding of the length of geologic time and the way in which organisms have changed throughout Earth's history.
  01 09 10
- Both very slow and sometimes sudden and catastrophic processes inside Earth and at its surface shape the landscape over time and can affect the relationship between human communities and their natural surroundings.
  01 11 12 13 14 15

SCIENTIFIC INQUIRY

Asking Questions and Making Predictions
1a 1b 9b

- Ask questions that can be investigated.
- Make and justify predictions based on prior experiences and observations.

Planning and Carrying Out Investigations
3a 3b 3c 4a 4e 4f 4g 4h 5a 5b 5c 9b

- In a small group, create a plan to answer a question.
- In a small group, identify variables that could affect an investigation.
- Select and safely use tools to make observations and collect data.
- Record observations and represent data in a variety of ways.

Analyzing and Interpreting Data
6a 6b 6c 6d 6e 7a 7b 8a 9b 9c

- Represent data using bar graphs and pictographs (many to one correspondence), and interpret them.
- Identify patterns in data and suggest explanations for discrepancies in data.
- Draw a conclusion based on the data gathered.
- Evaluate, with guidance, the method(s) used to answer a question.

Obtaining, Evaluating, and Communicating Information
2a 2b 4g 7d 7e 8b 9a 9b

- Communicate results and conclusions in a variety of ways.
- Recognize that explanations have to be supported by the available evidence and by knowledge considered scientific.
- Access and review, with support, information from a variety of reliable sources.

DESIGN PROCESS

Identifying and Defining Practical Problems
1c 2a 3f 9b

- Use prior knowledge to describe potential problems that can be solved through a simple design.
- Define the problem by developing criteria for measuring success based on function and aesthetics, and by identifying constraints such as available materials, time, or cost.

Researching, Planning, and Choosing a Solution
2a 2b 3d 3e 4f 4g 9b

- Brainstorm possible solutions to a practical problem, and identify and justify which solution to implement.
- Create a plan to solve the problem or meet the need, including steps to follow and a labelled diagram.

Constructing and Testing the Model or Prototype
4b 4c 4e 4f 4g 4h 5a 9b

- Construct an object, device, or system that addresses a possible solution to the design problem.
- Test the proposed object, device, or system with respect to the criteria and constraints.

Evaluating and Optimizing the Solution
4d 7b 7c 8c 9b

- Identify and make improvements to the object, device, or system with a rationale for making the changes.
- Recognize that designing a solution to a simple problem may have considerations such as cost, materials, time, and space.

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Science Practices

Scientific Inquiry

ASKING QUESTIONS AND MAKING PREDICTIONS

Science inquiry begins with a child's sense of wonder about the world. Asking questions stimulates curiosity, promotes the development of ideas, promotes discussion, helps clarify concepts, and can lead to a deeper understanding of a concept. As students progress across the grades, their questions should become more relevant, focused, and sophisticated, which requires teaching effective questioning strategies and giving students opportunities to ask and refine their questions. Making predictions is also an important part of science inquiry. Using prior knowledge, observations, and reasoning, students develop ideas to predict possible answers to questions, rather than simply making random guesses.

PLANNING AND CARRYING OUT INVESTIGATIONS

Throughout their schooling, students are expected to plan and carry out, with appropriate levels of support, investigations in the field or laboratory, working collaboratively as well as individually; investigations gradually become more systematic and require clarifying what counts as data and identifying variables that could affect an investigation. The data and observations that are collected are used to test existing understandings, revise them, or develop new understandings.

ANALYZING AND INTERPRETING DATA

Student investigations produce data that must be displayed and analyzed in order to derive meaning. Because patterns and trends in data are not always obvious, a range of tools including tables, graphical representations, and visualizations are used to identify significant features and patterns in the data and to interpret the results of the investigation.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students engage with multiple sources to obtain information that is used to evaluate the merit and validity of their claims, methods, and investigation designs. They develop facility with communicating clearly and persuasively the method(s) used and the ideas generated. Critiquing and communicating ideas individually and in groups is a critical activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations, as well as orally, in writing, and through extended discussions.

For more information about scientific inquiry and student expectations across the grades, consult *Kindergarten to Grade 4 Science: A Foundation for Implementation*.

Design Process

IDENTIFYING AND DEFINING PRACTICAL PROBLEMS

Technological problem solving involves identifying and defining problems that need to be solved. In order to define a problem, students identify the goals or criteria (what the solution needs to have) as well as constraints (limitations such as available tools and materials, time, dimensions, etc.).

RESEARCH, PLANNING, AND CHOOSING A SOLUTION

Research can be necessary to better understand a problem and to identify possible solutions. Students conduct their own research and consider multiple possible solutions to a given problem. They can then choose the best solution by comparing each possible solution against the criteria and constraints that have been identified.

CONSTRUCTING AND TESTING THE MODEL OR PROTOTYPE

Engineering uses models and simulations to analyze and test solutions to a problem. Students develop a plan to construct and/or test a prototype or model against the criteria and constraints that were identified.

EVALUATING AND OPTIMIZING THE SOLUTION

Optimizing the design solution involves a process in which solutions are systematically tested and refined and the final design is improved by trading off less important features for those that are more important.

For more information about the design process and student expectations across the grades, consult *Kindergarten to Grade 4 Science: A Foundation for Implementation*.