Fall

HOW THE FALL CURRICULUM CHARTS ARE ORGANIZED

The Learning Outcomes that follow from **Science** must be taught during the FALL season. Learning outcomes must be grounded in Nehiyaw Ways of Knowing and Land Based Learning. Note that all Attitudes and Skills listed at the end of each science unit are important and should be included as part of the unit of study, but are not highlighted as essential because it was inferred that they have been taught in elementary grades or are cross curricular.

These **Science** charts include suggested, although not exhaustive, connections to Nehiyaw Ways of Knowing and Land Based Learning. Throughout the year, teachers will collaborate and generate more/other ideas that will value add to the suggested connections.

Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning FALL ELO rows are highlighted
	UNIT A: MIX AND FLOW OF MATTER *BEGINNNING OF FALL (SEPTEMBER)		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Investigate and describe fluids used in technological devices and everyday materials	• **investigate and identify examples of fluids in household materials, technological devices, living things and natural environments**		**Water as a source of life, Rubbing alcohol after shaving, Ashes as a cleaning substance and charcoal.**
	• **explain the Workplace Hazardous Materials Information System (WHMIS) symbols for labelling substances; and describe the safety precautions to follow when handling, storing and disposing of substances at home and in the laboratory**		**Translate terms and symbols into Cree**
	• describe examples in which materials are prepared as fluids in order to facilitate transport, processing or use (e.g., converting mineral ores to liquids or slurries to facilitate transport, use of paint solvents to facilitate mixing and application of pigments, use of soapy water to carry away unwanted particles of material)		
	• identify properties of fluids that are important in their selection and use (e.g., lubricant properties of oils, compressibility of gases used in tires)		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning FALL ELO rows are highlighted
2. Investigate and describe the composition of fluids, and interpret the behaviour of materials in solution	• **distinguish among pure substances, mixtures and solutions, using common examples (e.g., identify examples found in households)**		**Mint tea, Rat root, jams, pop, milk**
	• **investigate the solubility of different materials, and describe their concentration (e.g., describe concentration in grams of solute per 100 mL of solution)**		
	• **investigate and identify factors that affect solubility and the rate of dissolving a solute in a solvent (e.g., identify the effect of temperature on solubility; identify the effect of particle size and agitation on rate of dissolving)**		
	• relate the properties of mixtures and solutions to the particle model of matter (e.g., recognize that the attraction between particles of solute and particles of solvent helps keep materials in solution)		
3. Investigate and compare the properties of gases and liquids; and relate variations in their viscosity, density, buoyancy and compressibility to the particle model of matter	• investigate and compare fluids, based on their viscosity and flow rate, and describe the effects of temperature change on liquid flow		
	• **observe the mass and volume of a liquid, and calculate its density using the formula d = m/v [Note: This outcome does not require students to perform formula manipulations or solve for unknown terms other than the density.]**		**Measuring land-based medicines natural to the Cree people. Trying to determine the quantity of different leaves or roots to combine into making medicines.**
	• **compare densities of materials; and explain differences in the density of solids, liquids and gases, using the particle model of matter**		
	• describe methods of altering the density of a fluid, and identify and interpret related practical applications (e.g., describe changes in buoyancy resulting from increasing the concentration of salt in water)		
	• **describe pressure as a force per unit area by using the formula p = F/A, and describe applications of pressure in fluids and everyday situations (e.g., describe pressure exerted by water in hoses, air in tires, carbon dioxide in fire extinguishers; explain the effects of flat heels and stiletto heels, using the concept of pressure)**		
	• investigate and compare the compressibility of liquids and gases		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning FALL ELO rows are highlighted
4. Identify, interpret and apply technologies based on properties of fluids	• describe technologies based on the solubility of materials (e.g., mining salt or potash by dissolving)		
	• describe and interpret technologies based on flow rate and viscosity (e.g., heavy oil extraction from tar sands, development of motor oils for different seasons, ketchup/mustard squeeze bottles)		
	• describe and interpret technologies for moving fluids from one place to another (e.g., intravenous lines, pumps and valves, oil and gas pipelines)		
	• construct a device that uses the transfer of fluids to apply a force or to control motion (e.g., construct a model hydraulic lift; construct a submersible that can be made to sink or float by transfer of a fluid; construct a model of a pump)		
SPECIFIC OUTCOMES FOR SKILLS			
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• define practical problems (e.g., How can we remove a salt coating from a bicycle or vehicle?)		
	• identify questions to investigate, arising from practical problems and issues (e.g., identify questions, such as: "What factors affect the speed with which a material dissolves?")		
	• phrase questions in a testable form, and clearly define practical problems (e.g., rephrase a question, such as: "Is salt very soluble?" to become "What is the most salt that can be dissolved in one litre of water at 23°C?")		
	• **design an experiment, and identify the major variables (e.g., design or apply a procedure for measuring the solubility of different materials)**		**Dissolving maple syrup using different cooking methods: baking, boiling, stirring, blending**
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• carry out procedures, controlling the major variables (e.g., carry out a test of the viscosity of different fluids)		
	• use instruments effectively and accurately for collecting data (e.g., measure the mass and volume of a given sample of liquid)		
	• construct and test prototype designs and systems (e.g., construct a model submarine that is controlled by an air hose connected to a syringe)		

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Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data (continued)	• use tools and apparatus safely (e.g., wear safety goggles during investigations of solution properties)		
	• organize data, using a format that is appropriate to the task or experiment (e.g., demonstrate the use of a database or spreadsheet for organizing information)		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• identify and suggest explanations for discrepancies in data (e.g., explain a loss in the volume of a liquid, by identifying such factors as evaporation or absorption by a filtering material)		
	• predict the value of a variable, by interpolating or extrapolating from graphical data (e.g., extrapolate results to predict how much solute will dissolve in a given solvent at a given temperature)		
	• identify new questions and problems that arise from what was learned (e.g., identify questions, such as: "What techniques are used to remove pollutants from air and water?")		
	• identify and evaluate potential applications of findings		
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• identify and correct practical problems in the way a prototype or constructed device functions (e.g., identify and seal leaks in a model fluid system)		
	• work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise		
	• communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means (e.g., show the differences in flow rate, using a data table and diagrams)		
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., attempt at home to repeat or extend a science investigation done at school; investigate applications of fluid properties in technologies used in the local community)		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning FALL ELO rows are highlighted
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness of and respect for aboriginal perspectives on the link between humans and the environment)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., regularly repeat measurements or observations to increase the precision of evidence)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., assume responsibility for their share of work in preparing for investigations and in gathering and recording evidence; consider alternative ideas and approaches suggested by members of the group; share the responsibility for difficulties encountered in an activity)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., recognize that the disposal of materials through drains creates needs for waste water treatment and may result in downstream environmental impacts)		
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., take the time to organize their work area so that accidents can be prevented; read the labels on materials before using them, and ask for help if safety symbols are not clear or understood; clean their work area during and after an activity)		
UNIT B: CELLS AND SYSTEMS *LATER PART OF FALL (OCTOBER/NOVEMBER)			
SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY			
1. Investigate living things; and identify and apply scientific ideas used to interpret their general structure, function and organization	• investigate and describe example scientific studies of the characteristics of living things (e.g., investigate and describe an ongoing scientific study of a locally-found organism)		
	• **apply the concept of system in describing familiar organisms and analyzing their general structure and function**		**Use local examples such as fish or beaver living in an ecosystem. Emphasize the interconnectedness of people, animals, plants, the air and mother earth.**

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1. Investigate living things; and identify and apply scientific ideas used to interpret their general structure, function and organization (continued)	• **illustrate and explain how different organisms have similar functions that are met in a variety of ways (e.g., recognize food gathering as a common function of animals, and note a variety of food-gathering structures)**		**Illustrate and explain through a powerpoint presentation how local animals gather food (eg. birds, fish, large mammals, bear, insects, etc.) and compare the similarities and differences in their food gathering techniques. Explain how their food gathering techniques are similar or different to humans. Finally, complare to how local plants gather food.**
2. Investigate and describe the role of cells within living things	• **describe the role of cells as a basic unit of life**		
	• **analyze similarities and differences between single-celled and multicelled organisms (e.g., compare, in general terms, an amoeba and a grizzly bear, a single-celled alga and a poplar tree)**		**Focus on local plants and animals**
	• **distinguish between plant and animal cells (e.g., distinguish between cell walls and cell membranes)**		
	• **describe the movement of gases and liquids into and out of cells during diffusion and osmosis, based on concentration differences [Note: This outcome requires a general understanding of processes, not a detailed analysis of mechanisms.]**		**Explain diffusion and osmosis using concrete examples such as diffusion of smoke in the air when building a fire (diffusion), or watering a tree and the water travels up the roots and trunk and demonstrates the circulation system**
	• **examine plant and animal structures; and identify contributing roles of cells, tissues and organs**		
3. Interpret the healthy function of human body systems, and illustrate ways the body reacts to internal and external stimuli	• **describe, in general terms, body systems for respiration, circulation, digestion, excretion and sensory awareness (e.g., describe how blood is circulated throughout the body to carry oxygen and nutrients to the body's various tissues and organs)**		**Explore Indigenous knowledge related to taking care of the body naturally, using plants as medicine, etc. and how one system breaking down affects all other systems in the body**

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3. Interpret the healthy function of human body systems, and illustrate ways the body reacts to internal and external stimuli (continued)	• **describe, in general terms, the role of individual organs and tissues in supporting the healthy functioning of the human body (e.g., the role of lungs in exchanging oxygen and carbon dioxide, the role of bronchia in providing a passageway for air)**		**Invite an Elder or knowledge keeper to share wisdom related to healthy functioning of the human body and roles of individual organs**
	• **describe ways in which various types of cells contribute to the healthy functioning of the human body (e.g., describe the roles of individual cells in nerves, muscle, blood, skin and bone)**		
	• **describe changes in body functions in response to changing conditions (e.g., changes in heart rate in response to exercise, change in metabolism in response to lower temperature, reflex responses to stimuli)**		**Chart changes in body functions of people engaged in different activities - eg hunting, participating in a feast, sleeping, etc. Form conclusions based on the data recorded in the chart**
4. Describe areas of scientific investigation leading to new knowledge about body systems and to new medical applications	• identify examples of research into functions and dysfunctions of human cells, organs or body systems		
	• describe ways in which research about cells, organs and systems has brought about improvements in human health and nutrition (e.g., development of medicines; immunization procedures; diets based on the needs of organs, such as the heart)		
	• investigate and describe factors that affect the healthy function of the human respiratory, circulatory and digestive systems (e.g., investigate the effect of illness, aging or air quality on the function of the respiratory system)		
SPECIFIC OUTCOMES FOR SKILLS			
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• identify questions to investigate (e.g., identify questions that arise from their own observations of plant and animal diversity)		
	• rephrase questions in a testable form (e.g., rephrase a question, such as: "Why this structure?" to become questions, such as: "How is this structure used by the organism?", "How would the organism be affected if this structure were absent or did not function?" or "What similar structures do we find in other organisms?")		
	• formulate operational definitions of major variables and other aspects of their investigations (e.g., define body systems in terms of the functions they perform)		

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Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• **use instruments—including microscopes—effectively and accurately for collecting data (e.g., use a microscope to produce a clear image of cells)**		
	• **estimate measurements (e.g., estimate the size of an object viewed under a microscope)**		
	• observe and record data, and produce simple line drawings (e.g., draw cells and organisms)		
	• organize data, using a format that is appropriate to the task or experiment (e.g., compare the structure and function of two or more organisms, using charts and drawings)		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• identify strengths and weaknesses of different methods of collecting and displaying data (e.g., compare methods of measuring heart rate)		
	• identify and suggest explanations for discrepancies in data (e.g., explain variations in the heart rate and blood pressure of the same individual at different times during the day)		
	• compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs and line graphs (e.g., prepare charts that compare structures of different organisms)		
	• identify new questions and problems that arise from what was learned		
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• receive, understand and act on the ideas of others (e.g., adopt and use an agreed procedure for preparing diagrams and charts)		
	• communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means		
	• work cooperatively with team members to develop and carry out a plan (e.g., prepare a class presentation on the digestive system, including a model constructed by the group)		
	• evaluate individual and group processes used in planning, problem solving, decision making and completing a task (e.g., evaluate processes used in completing a cooperative group project)		

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	SPECIFIC OUTCOMES FOR ATTITUDES		
Interest in Science	Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., select and explore media on topics related to the diversity of living things and the maintenance of health; express interest in science-related/ technology-related careers that contribute to the welfare of living things)		
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., recognize that a wide range of people working in different fields have contributed to scientific and medical knowledge)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., consider a wide variety of possible interpretations of their observations of animal structures and functions; critically evaluate inferences and conclusions, basing their arguments on fact rather than opinion)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., assume responsibility for their share of work in preparing for investigations and in gathering and recording evidence; consider alternative ideas and approaches suggested by members of the group; share the responsibility for difficulties encountered in an activity)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., show interest in the health of individuals in their family and community; assume personal responsibility for the impact of their actions on the health of others and for the welfare and survival of other living things)		
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., wear proper safety attire, without having to be reminded; follow appropriate safety procedures in handling biological material; clean their work area during and after an activity; ensure the proper disposal of materials)		

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Winter

HOW THE WINTER CURRICULUM CHARTS ARE ORGANIZED

The Learning Outcomes that follow from **Science** must be taught during the WINTER season. Learning outcomes must be grounded in Nehiyaw Ways of Knowing and Land Based Learning. Note that all Attitudes and Skills listed at the end of each science unit are important and should be included as part of the unit of study, but are not highlighted as essential because it was inferred that they have been taught in elementary grades or are cross curricular. Science outcomes identified in this chart also cross over to the SPRING season.

These **Science** charts include suggested, although not exhaustive, connections to Nehiyaw Ways of Knowing and Land Based Learning. Throughout the year, teachers will collaborate and generate more/other ideas that will value add to the suggested connections.

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	UNIT C: LIGHT AND OPTICAL SYSTEMS		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Investigate the nature of light and vision; and describe the role of invention, explanation and inquiry in developing our current knowledge	• **identify challenges in explaining the nature of light and vision (e.g., recognize that past explanations for vision involved conflicting ideas about the interaction of eyes and objects viewed; identify challenges in explaining upside-down images, rainbows and mirages)**		**Use sun dogs as an example**
	• investigate the development of microscopes, telescopes and other optical devices; and describe how these developments contributed to the study of light and other areas of science		
	• investigate light beams and optical devices, and identify phenomena that provide evidence of the nature of light (e.g., evidence provided by viewing the passage of light through dusty air or cloudy water)		
2. Investigate the transmission of light, and describe its behaviour using a geometric ray model	• **investigate how light is reflected, transmitted and absorbed by different materials; and describe differences in the optical properties of various materials (e.g., compare light absorption of different materials; identify materials that transmit light; distinguish between clear and translucent materials; identify materials that will reflect a beam of light as a coherent beam)**		**Focus on local materials that are found within the community and surrounding areas (sun glasses, Inuit traditional sunglasses to prevent snow blindness), color of clothing or buildings, muddy water or clear water, etc.**

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2. Investigate the transmission of light, and describe its behaviour using a geometric ray model (continued)	• measure and predict angles of reflection		
	• **investigate, measure and describe the refraction of light through different materials (e.g., measure differences in light refraction through pure water, salt water and different oils)**		**Explore traditional Indigenous stories about rainbows**
	• investigate materials used in optical technologies; and predict the effects of changes in their design, alignment or composition		
3. Investigate and explain the science of image formation and vision, and interpret related technologies	• **demonstrate the formation of real images, using a double convex lens, and predict the effects of changes in the lens position on the size and location of images (e.g., demonstrate a method to produce a magnified or reduced image by altering the placement of one or more lenses)**		
	• demonstrate and explain the use of microscopes; and describe, in general terms, the function of eyeglasses, binoculars and telescopes		
	• explain how objects are seen by the eye, and compare eyes with cameras (e.g., compare focusing mechanisms; compare the automatic functions of the eye with functions in an automatic camera)		
	• **compare the function and design of the mammalian eye with that of other vertebrates and invertebrates (e.g., amphibians; fish; squid; shellfish; insects, such as the housefly)**		
	• investigate and describe the development of new technologies to enhance human vision (e.g., laser surgery on eyes, development of technologies to extend night vision)		
	• investigate and interpret emerging technologies for storing and transmitting images in digital form (e.g., digital cameras, infrared imaging, remote imaging technologies)		
SPECIFIC OUTCOMES FOR SKILLS			
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• identify questions to investigate (e.g., ask about the role of eyeglasses in improving vision)		
	• define and delimit questions to facilitate investigation (e.g., rephrase a question, such as: "Is plastic the best material to use in eyeglasses?" to become "Which material refracts light the most?")		

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Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions (continued)	• design an experiment, and identify the major variables	❄	
	• state a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict the effect of dissolved materials on the refraction of light in a liquid)		
	• formulate operational definitions of major variables and other aspects of their investigations (e.g., operationally define "refraction" and "beam of light")		
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• carry out procedures, controlling the major variables		
	• observe and record data, and prepare simple line drawings (e.g., prepare a drawing of the path of a light beam toward and away from a mirror)		
	• use instruments effectively and accurately for collecting data (e.g., measure angles of reflection; use a light sensor to measure light intensity)		
	• organize data, using a format that is appropriate to the task or experiment (e.g., demonstrate use of a database or spreadsheet for organizing information)		
	• use tools and apparatus safely (e.g., use lasers only in ways that do not create a risk of light entering anyone's eyes)		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• predict the value of a variable by interpolating or extrapolating from graphical data (e.g., predict the angle of a refracted beam of light)		
	• identify strengths and weaknesses of different ways of collecting and displaying data (e.g., evaluate different approaches to testing a lens)		
	• state a conclusion, based on experimental data, and explain how evidence gathered supports or refutes an initial idea (e.g., write a conclusion on the effect of dissolved materials on the refraction of light through water)		
	• identify new questions and problems that arise from what was learned (e.g., ask questions about new technologies for improving human vision and about the principles on which these technologies are based)		

Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning WINTER ELO rows are highlighted
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• receive, understand and act on the ideas of others (e.g., act on the suggestions of others in testing and manipulating various lens combinations) • recommend an appropriate way of summarizing and interpreting	❄	
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., choose to investigate challenging topics; seek information from a variety of sources; express interest in science- and technology-related careers)	❄	
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness of and respect for the research, care and craftsmanship involved in developing means to enhance human vision)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., ask questions to clarify meaning or confirm their understanding; take the time to accurately gather evidence and use instruments carefully; consider observations and ideas from a number of sources during investigations and before drawing conclusions)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., choose a variety of strategies, such as active listening, paraphrasing and questioning, in order to understand other points of view; consider alternative ideas and interpretations suggested by members of the group)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., recognize that light can contribute to light pollution)		
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., select safe methods in using optical devices; readily alter a procedure to ensure the safety of members of the group)		

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	UNIT D: MECHANICAL SYSTEMS ***WINTER/EARLY SPRING**		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Illustrate the development of science and technology by describing, comparing and interpreting mechanical devices that have been improved over time	• **investigate and provide examples of mechanical devices used in the past to meet particular needs (e.g., describe and interpret devices developed to move water or be moved by water, such as the Persian wheel, Archimedes' screw, mill wheel)**	 	**Explore traditional devices for hunting, building fires, trapping, hide tanning stations, spear throwing, bow and arrow, etc.**
	• illustrate how a common need has been met in different ways over time (e.g., development of different kinds of lifting devices)		
	• illustrate how trial and error and scientific knowledge both play a role in technological development (e.g., development of aircraft)		
2. Analyze machines by describing the structures and functions of the overall system, the subsystems and the component parts	• **analyze a mechanical device, by:** **– describing the overall function of the device** **– describing the contribution of individual components or subsystems to the overall function of the device** **– identifying components that operate as simple machines**		**Use traditional Indigenous mechanical devices such as bow and arrow and compare to a compund bow**
	• identify the source of energy for some familiar mechanical devices		
	• **identify linkages and power transmissions in a mechanical device, and describe their general function (e.g., identify the purpose and general function of belt drives and gear systems within a mechanical device)**		
3. Investigate and describe the transmission of force and energy between parts of a mechanical system	• analyze mechanical devices to determine speed ratios and force ratios		
	• build or modify a model mechanical system to provide for different turning ratios between a driving and driven shaft, or to achieve a given force ratio)		
	• compare theoretical and actual values of force ratios, and propose explanations for discrepancies (e.g., identify frictional forces, and estimate their effect on efficiency)		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning WINTER ELO rows are highlighted
3. Investigate and describe the transmission of force and energy between parts of a mechanical system (continued)	• **identify work input and work output in joules for a simple machine or mechanical system (e.g., use a device to lift a measured mass an identified distance, then calculate the work output)**		
	• describe fluid pressure qualitatively and quantitatively, by: – explaining how forces are transferred in all directions – describing pressure in units of force per unit area		
	• describe how hydraulic pressure can be used to create a mechanical advantage in a simple hydraulic jack (e.g., describe the relationship among force, piston size and distance moved, using different sized syringes linked by tubing)		
	• describe and interpret technologies based on hydraulics and pneumatics (e.g., applications in hydraulic lifts and air-driven tools)		
4. Analyze the social and environmental contexts of science and technology, as they apply to the development of mechanical devices	• evaluate the design and function of a mechanical device in relation to its efficiency and effectiveness, and identify its impacts on humans and the environment		
	• develop and apply a set of criteria for evaluating a given mechanical device, and defend those criteria in terms of relevance to social and environmental needs		
	• illustrate how technological development is influenced by advances in science, and by changes in society and the environment		
SPECIFIC OUTCOMES FOR SKILLS			
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• identify practical problems (e.g., identify problems related to the effectiveness or efficiency of a mechanical device)		
	• identify questions to investigate arising from practical problems (e.g., "What is the efficiency of this device?")		
	• propose alternative solutions to a practical problem, select one, and develop a plan		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning WINTER ELO rows are highlighted
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions (continued)	• formulate operational definitions of major variables and other aspects of their investigations (e.g., define "frictional force" by identifying a method to be used for measuring it)		
	• select appropriate methods and tools for collecting data to solve problems (e.g., develop or apply appropriate methods for measuring speed ratios and force ratios; plan and conduct a search, using a wide variety of electronic sources)		
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• research information relevant to a given problem		
	• select and integrate information from various print and electronic sources or from several parts of the same source		
	• construct and test prototype designs and systems		
	• carry out procedures, controlling the major variables (e.g., ensure that materials to be tested are of the same size and are tested under identical conditions)		
	• organize data, using a format that is appropriate to the task or experiment		
	• use tools and apparatus safely		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• identify and correct practical problems in the way a prototype or constructed device functions		
	• evaluate designs and prototypes in terms of function, reliability, safety, efficiency, use of materials and impact on the environment (e.g., test and evaluate the efficiency and reliability of a prototype device to lift a given mass from the floor to a tabletop)		
	• identify and evaluate potential applications of findings (e.g., identify possible applications of a simple machine or mechanical system they have studied)		
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• use specific language that is scientifically and technologically appropriate (e.g., use such terms as "system," "subsystem," "component" and "function" in describing a mechanical system)		
	• communicate practical problems, plans and results in a variety of ways, using written and oral language, data tables, graphs, drawings and other means (e.g., describe, using pictures and words, the transmission of a force through a mechanical system)		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning WINTER ELO rows are highlighted
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results (continued)	• work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise		
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., investigate examples of mechanical devices in their home and community; ask questions about techniques and materials used; show an interest in related careers and hobbies)		
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., recognize that varied solutions to similar problems have been developed by different cultures throughout history; appreciate that different approaches to problems lead to different solutions, and that each may have merits for particular applications)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., report the limitations of their designs; continue working on a problem or research project until the best possible solutions or answers are uncovered)		
Collaboration	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., report the limitations of their designs; continue working on a problem or research project until the best possible solutions or answers are uncovered)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., consider the impacts of their designs on society and the environment; participate in discussions on the appropriateness of a given technology)		
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., readily alter a procedure to ensure the safety of members of the group; carefully manipulate materials, using skills learned in class or elsewhere; listen attentively to safety procedures given by the teacher)		

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Spring

HOW THE SPRING CURRICULUM CHARTS ARE ORGANIZED

The Learning Outcomes that follow from **Science** must be taught during the SPRING season. Learning outcomes must be grounded in Nehiyaw Ways of Knowing and Land Based Learning. Note that all Attitudes and Skills listed at the end of each science unit are important and should be included as part of the unit of study, but are not highlighted as essential because it was inferred that they have been taught in elementary grades or are cross curricular. Science outcomes identified in this chart also cross over from the WINTER season.

These **Science** charts include suggested, although not exhaustive, connections to Nehiyaw Ways of Knowing and Land Based Learning. Throughout the year, teachers will collaborate and generate more/other ideas that will value add to the suggested connections.

Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
	UNIT D: MECHANICAL SYSTEMS ***WINTER/EARLY SPRING**		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Illustrate the development of science and technology by describing, comparing and interpreting mechanical devices that have been improved over time	• **investigate and provide examples of mechanical devices used in the past to meet particular needs (e.g., describe and interpret devices developed to move water or be moved by water, such as the Persian wheel, Archimedes' screw, mill wheel)**		**Explore traditional devices for hunting, building fires, trapping, hide tanning stations, spear throwing, bow and arrow, etc.**
	• illustrate how a common need has been met in different ways over time (e.g., development of different kinds of lifting devices)		
	• illustrate how trial and error and scientific knowledge both play a role in technological development (e.g., development of aircraft)		
2. Analyze machines by describing the structures and functions of the overall system, the subsystems and the component parts	• **analyze a mechanical device, by:** **– describing the overall function of the device** **– describing the contribution of individual components or subsystems to the overall function of the device** **– identifying components that operate as simple machines**		**Use traditional Indigenous mechanical devices such as bow and arrow and compare to a compund bow**
	• identify the source of energy for some familiar mechanical devices		

Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
2. Analyze machines by describing the structures and functions of the overall system, the subsystems and the component parts (continued)	• **identify linkages and power transmissions in a mechanical device, and describe their general function (e.g., identify the purpose and general function of belt drives and gear systems within a mechanical device)**		
3. Investigate and describe the transmission of force and energy between parts of a mechanical system	• analyze mechanical devices to determine speed ratios and force ratios		
	• build or modify a model mechanical system to provide for different turning ratios between a driving and driven shaft, or to achieve a given force ratio		
	• compare theoretical and actual values of force ratios, and propose explanations for discrepancies (e.g., identify frictional forces, and estimate their effect on efficiency)		
	• **identify work input and work output in joules for a simple machine or mechanical system (e.g., use a device to lift a measured mass an identified distance, then calculate the work output)**		
	• describe fluid pressure qualitatively and quantitatively, by: – explaining how forces are transferred in all directions – describing pressure in units of force per unit area		
	• describe how hydraulic pressure can be used to create a mechanical advantage in a simple hydraulic jack (e.g., describe the relationship among force, piston size and distance moved, using different sized syringes linked by tubing)		
	• describe and interpret technologies based on hydraulics and pneumatics (e.g., applications in hydraulic lifts and air-driven tools)		
4. Demonstrate and describe processes used in developing, evaluating and improving structures that will meet human needs with a margin of safety	• evaluate the design and function of a mechanical device in relation to its efficiency and effectiveness, and identify its impacts on humans and the environment		
	• develop and apply a set of criteria for evaluating a given mechanical device, and defend those criteria in terms of relevance to social and environmental needs		
	• illustrate how technological development is influenced by advances in science, and by changes in society and the environment		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
	SPECIFIC OUTCOMES FOR SKILLS		
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• identify practical problems (e.g., identify problems related to the effectiveness or efficiency of a mechanical device)		
	• identify questions to investigate arising from practical problems (e.g., "What is the efficiency of this device?")		
	• propose alternative solutions to a practical problem, select one, and develop a plan		
	• select appropriate methods and tools for collecting data to solve problems (e.g., develop or apply appropriate methods for measuring speed ratios and force ratios; plan and conduct a search, using a wide variety of electronic sources)		
	• formulate operational definitions of major variables and other aspects of their investigations (e.g., define "frictional force" by identifying a method to be used for measuring it)		
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• research information relevant to a given problem		
	• select and integrate information from various print and electronic sources or from several parts of the same source		
	• construct and test prototype designs and systems		
	• carry out procedures, controlling the major variables (e.g., ensure that materials to be tested are of the same size and are tested under identical conditions)		
	• organize data, using a format that is appropriate to the task or experiment		
	• use tools and apparatus safely		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• identify and correct practical problems in the way a prototype or constructed device functions		
	• evaluate designs and prototypes in terms of function, reliability, safety, efficiency, use of materials and impact on the environment (e.g., test and evaluate the efficiency and reliability of a prototype device to lift a given mass from the floor to a tabletop)		
	• identify and evaluate potential applications of findings (e.g., identify possible applications of a simple machine or mechanical system they have studied)		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• use specific language that is scientifically and technologically appropriate (e.g., use such terms as "system," "subsystem," "component" and "function" in describing a mechanical system) • communicate practical problems, plans and results in a variety of ways, using written and oral language, data tables, graphs, drawings and other means (e.g., describe, using pictures and words, the transmission of a force through a mechanical system) • work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise		
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., investigate examples of mechanical devices in their home and community; ask questions about techniques and materials used; show an interest in related careers and hobbies)		
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., recognize that varied solutions to similar problems have been developed by different cultures throughout history; appreciate that different approaches to problems lead to different solutions, and that each may have merits for particular applications)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., report the limitations of their designs; continue working on a problem or research project until the best possible solutions or answers are uncovered)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., accept various roles within a group, including that of leadership; understand that they can disagree with others but still work in a collaborative manner; share the responsibility for difficulties encountered during an activity)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., consider the impacts of their designs on society and the environment; participate in discussions on the appropriateness of a given technology)		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., readily alter a procedure to ensure the safety of members of the group; carefully manipulate materials, using skills learned in class or elsewhere; listen attentively to safety procedures given by the teacher)		
UNIT E: FRESHWATER AND SALTWATER SYSTEMS			
SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY			
1. Describe the distribution and characteristics of water in local and global environments, and identify the significance of water supply and quality to the needs of humans and other living things	• **describe, in general terms, the distribution of water in Alberta, Canada and the world; and interpret information about water characteristics (e.g., identify glaciers, snow, polar icecaps, ground water and oceans as components of Earth's water; interpret graphical information on the availability of potable water)**		**Explore how water is part of renewal in spring. Explore how each community within KTC gets its potable water and challenges related to good water supply. Explore how water changes from winter to spring and the flow of water throughout the KTC communities**
	• recognize that fresh water and salt water contain varying amounts of dissolved materials, particulates and biological components; and interpret information on these component materials		
	• **identify major factors used in determining if water is potable, and describe and demonstrate tests of water quality (e.g., investigate and describe the physical characteristics of a sample of water, such as clarity, salinity and hardness; investigate biological tests)**		**Invite speakers from the local water treatment plant or health departments to demonstrate tests to see if water is potable. Explore traditional Indigenous stories that talk about how horses only drink water that is safe.**
	• **describe, in general terms, methods for generating fresh water from salt water, based on evaporation, distillation and reverse osmosis**		**Explore methods to convert stream, river or lake water into safe, potable water**
2. Investigate and interpret linkages among landforms, water and climate	• describe the processes of erosion and deposition resulting from wave action and water flow, by: – identifying dissolved solids and sediment loads, and identifying sources and endpoints for these materials – describing how waves and tides are generated and how they interact with shorelines		

Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
2. Investigate and interpret linkages among landforms, water and climate (continued)	• investigate and describe stream characteristics (e.g., describe the slope, flow rate and stream profile characteristics of a model stream on a stream table)		
	• describe processes leading to the development of ocean basins and continental drainage systems (e.g., describe the formation of geological features on the ocean floor, such as continental shelves and trenches)		
	• identify evidence of glacial action, and analyze factors affecting the growth and attrition of glaciers and polar icecaps (e.g., identify factors that affect the size of polar ice sheets and the Columbia Icefield)		
	• describe the movement of ocean currents and its impact on regional climates (e.g., effects of the Gulf Stream, Labrador Current, El Niño, La Niña)		
3. Analyze factors affecting productivity and species distribution in marine and freshwater environments	• investigate life forms found in fresh water and salt water, and identify and interpret examples of adaptations to these environments (e.g., describe and interpret examples of fish and invertebrate species found in a local freshwater environment)		
	• **analyze factors that contribute to the development of adaptations in species found in saltwater and freshwater environments**		**Explore how fish such as whitefish, pickeral and jackfish adapt to their environments. Look at how the salmon adapts from moving from salt water to fresh water.**
	• investigate and interpret examples of seasonal, short-term and long-term change in populations of living things found in aquatic environments (e.g., algal blooms, changes in local freshwater fish populations, cod and salmon stock depletion)		
	• analyze relationships between water quality and living things, and infer the quality of water based on the diversity of life supported by it		
4. Analyze human impacts on aquatic systems; and identify the roles of science and technology in addressing related questions, problems and issues	• **analyze human water uses, and identify the nature and scope of impacts resulting from different uses (e.g., identify pollutants in ground water and surface water systems resulting from domestic and industrial use; analyze the effects of agriculture and forestry practices on stream flow and water quality)**		**Explore how fertilizers contribute to blue algae. Explore how pesticides and insecticides get into the water system and its impact on the quality of the water. Explore impact of human activity (and industry) on local water systems. Identfy if landfill residue seeps into the water supply.**

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
4. Analyze human impacts on aquatic systems; and identify the roles of science and technology in addressing related questions, problems and issues (continued)	• **identify current practices and technologies that affect water quality, evaluate environmental costs and benefits, and identify and evaluate alternatives (e.g., research and analyze alternatives for ensuring safe supplies of potable water; research, analyze and debate alternatives for a specific water quality issue, such as the location and design of a landfill, the protection of a natural waterway, the use of secondary and tertiary wastewater treatment, the salinization of soils due to irrigation, the eutrophication of ponds and streams due to excess use of phosphates in fertilizers and detergents, or a proposal to export water resources)**		**Explore the impact of a broken pipeline and how it affects the water quality.**
	• illustrate the role of scientific research in monitoring environments and supporting development of appropriate environmental technologies (e.g., describe a local example of aquatic monitoring, and describe how this research contributes to watershed management)		
	• **provide examples of problems that cannot be solved using scientific and technological knowledge alone (e.g., the need to prevent pollutants from entering aquatic environments, the need to avoid damage from ice sheets and icebergs)**		**Discuss how each student has a responsibility for the quality of their water supply (eg. throwing garbage in the lake, etc.) Students can create a campaign promoting safe water supply and how the community can do their part to protect their water supply - all stewards of the environment.**
SPECIFIC OUTCOMES FOR SKILLS			
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• identify science-related issues and problems		
	• identify questions to investigate, arising from science-related issues		
	• select appropriate methods and tools for collecting relevant data and information (e.g., plan and conduct a search, using a wide variety of electronic sources)		
	• design an experiment, and identify the major variables (e.g., design an experiment to compare the characteristics of two water samples)		

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Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• research information relevant to a given issue		
	• select and integrate information from various print and electronic sources or from several parts of the same source (e.g., summarize information on a river basin)		
	• identify strengths and weaknesses of different methods of collecting and displaying data (e.g., identify strengths and weaknesses of technologies used to monitor and map changes in stream flow)		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• apply given criteria for evaluating evidence and sources of information (e.g., assess the authenticity and reliability of electronic sources)		
	• predict the value of a variable, by interpolating or extrapolating from graphical data (e.g., predict future stocks of fish based on long-term data)		
	• interpret patterns and trends in data, and infer and explain relationships among the variables (e.g., relate climates to proximity to oceans and to the characteristics of ocean currents)		
	• identify new questions and problems arising from what was learned (e.g., identify questions, such as: "Can ocean currents be modified?", "Is kelp a viable source of food?", "How would icecap melting change Canadian coastlines?")		
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures and results (e.g., use such terms as salinity, currents and basins when describing oceans and their characteristics)		
	• communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means (e.g., create a concept map, linking the different stages of the water cycle; prepare a multimedia presentation on changing climatic conditions and the effects on glaciers, ice sheets and water levels, incorporating graphics, audio, visuals and text gathered from remote sources)		

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Big Idea, Major Concepts, GLOs	Specific Learning Outcomes ELOs are bold; Others are *need to know* or *worth being familiar with*	Season	Nehiyaw Ways of Knowing and Land Based Learning SPRING ELO rows are highlighted
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results (continued)	• evaluate individual and group processes used in planning, problem solving, decision making and completing a task (e.g., discuss advantages and disadvantages of different research methods and sources used to gather information on an ocean basin)		
	• defend a given position on an issue, based on their findings		
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., express interest in conducting scientific investigations of their own design; take an interest in media reports on environmental issues, and seek out further information from a variety of sources; take an interest in observing and interpreting their environment during personal and group excursions)		
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness of and respect for the contributions of indigenous peoples to knowledge of the environment)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., seek data that is accurate and based on appropriate methods of investigation; consider observations and ideas from a number of sources before drawing conclusions)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., share observations and ideas with other members of a group, and consider alternative ideas suggested by other group members; share the responsibility for carrying out decisions)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., consider immediate and long-term consequences of personal and group actions; objectively identify potential conflicts between responding to human wants and needs and protecting the environment)		
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., select safe methods and tools for collecting evidence and solving problems; readily alter a procedure to ensure the safety of members of the group)		