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: BIOLOGICAL DIVERSITY *FALL (SEPTEMBER)		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Investigate and interpret diversity among species and within species, and describe how diversity contributes to species survival	• **observe variation in living things, and describe examples of variation among species and within species (e.g., observe and describe characteristics that distinguish two closely related species)**		**Focus on local species (example: perch vs walleye, coyote vs wolf; deer vs moose.)**
	• identify examples of niches, and describe the role of variation in enabling closely related living things to survive in the same ecosystem (e.g., investigate different bird species found in a local park ecosystem, and infer how each is adapted to life within that ecosystem)		
	• **investigate and interpret dependencies among species that link the survival of one species to the survival of others** **– identify examples of symbiotic relationships (e.g., organisms that benefit other organisms by providing habitat, food, means of fertilization, or a source of oxygen)** **– classify symbiotic relationships as mutualism, commensalism, parasitism**		**Bees and flowers; tics and animals/ humans; leeches; blue algae;**
	• identify the role of variation in species survival under changing environmental conditions (e.g., resistance to disease, ability to survive in severe environments)		

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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 the nature of reproductive processes and their role in transmitting species characteristics	• **distinguish between sexual and asexual reproduction, and identify and interpret examples of asexual and sexual reproduction in different species, by:** **– describing mechanisms of asexual reproduction including binary fission, budding and the production of spores** **– describing mechanisms of sexual reproduction (e.g., cross-fertilization in seed plants, sexual reproduction in mammals)** **– describing examples of organisms that show both sexual and asexual reproduction (e.g., yeasts that reproduce both by budding and sexual reproduction; plants that reproduce through suckering, runners or bulbs, as well as by seed production)** **– describing the formation of zygote and embryo in plant and animal reproduction**		**Focus on the local environment**
	• describe examples of variation of characteristics within a species, and identify examples of both discrete and continuous variation (e.g., hand clasping preference is an example of a discrete variation, the length of human hands varies on a continuum)		
	• **investigate the transmission of characteristics from parents to offspring, and identify examples of characteristics in offspring that are:** **– the same as the characteristics of both parents** **– the same as the characteristics of one parent** **– intermediate between parent characteristics** **– different from both parents**		**Example: Compare characteristics of different tribes such as Blackfoot characteristics to Cree characteristics; look at the characteristics of children in blended families (if students are comfortable discussing)**
	• distinguish those characteristics that are heritable from those that are not heritable, and identify characteristics for which heredity and environment may both play a role (e.g., recognize that eye colour is heritable but that scars are not; recognize that a person's height and weight may be largely determined by heredity but that diet may also play a role)		
	• **identify examples of dominant and recessive characteristics and recognize that dominance and recessiveness provide only a partial explanation for the variation of characteristics in offspring**		**Straight hair is a recessive gene and curly hair is a dominant gene and generally speaking, Indigenous people have straight hair.**

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3. Describe, in general terms, the role of genetic materials in the continuity and variation of species characteristics; and investigate and interpret related technologies	• **describe, in general terms, the role and relationship of chromosomes, genes and DNA**		
	• **distinguish between cell division that leads to identical daughter cells, as in binary fission and mitosis, and cell division that leads to formation of sex cells, as in meiosis; and describe, in general terms, the synthesis of genetic materials that takes place during fertilization [Note: At this level, students should understand that the formation of sex cells involves the halving of the parent cell's genetic materials and that this process leads to zygote formation. Opportunity for further study of the specific stages of cell division will be provided in senior high school courses (e.g., prophase, metaphase, anaphase, telophase).]**		**Invite Elders to tell stories about how children are given characteristics from both parents to create a totally new human being.**
	• **compare sexual and asexual reproduction, in terms of the advantages and disadvantages (e.g., recognize that asexual reproduction provides an efficient means of transmitting characteristics and that sexual reproduction provides an opportunity for recombination of characteristics)**		**Compare asexual production (eg. worm or blue algae) to sexual production (eg. fish spawning).**
	• distinguish between, and identify examples of, natural and artificial selection (e.g., evolution of beak shapes in birds, development of high milk production in dairy cows)		
	• **describe, in simple terms, some genetic technologies (e.g., cloning and genetic engineering); and identify questions and issues related to their application**		
4. Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making	• describe the relative abundance of species on Earth and in different environments (e.g., note the overall abundance of insect species; note that in harsh environments there are relatively fewer species found than in temperate and tropical environments)		
	• **describe ongoing changes in biological diversity through extinction and extirpation of native species, and investigate the role of environmental factors in causing these changes (e.g., investigate the effect of changing river characteristics on the variety of species living in the river; investigate the effect of changing land use on the survival of wolf or grizzly bear populations)**		**Focus on local examples of extirpation. Land is being affected- Examples: the ground is unstable due to concepts of errosion.**

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4. Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making (continued)	• evaluate the success and limitations of various local and global strategies for minimizing loss of species diversity (e.g., breeding of endangered populations in zoos, development of seed banks, designating protected areas, development of international treaties regulating trade of protected species and animal parts)		
	• investigate and describe the use of biotechnology in environmental, agricultural or forest management; and identify potential impacts and issues (e.g., investigate issues related to the development of patented crop varieties and varieties that require extensive chemical treatments; identify issues related to selective breeding in game farming and in the rearing of fish stocks)		
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 (e.g., identify issues related to loss of species diversity)		
	• identify questions to investigate arising from science-related issues (e.g., "What factors affect the ability of organisms to survive and reproduce in this ecosystem?")		
	• state a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict changes to an area of local parkland that is subject to intense use; hypothesize means of impact, such as soil compaction and disturbance of nest sites)		
	• define and delimit questions and problems to facilitate investigation (e.g., delimit an electronic search for information on species survival by framing a question about a specific group of organisms or a specific ecosystem)		
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• observe and record data, and prepare simple line drawings (e.g., compare two related plants by measuring, describing and drawing them)		
	• estimate measurements (e.g., estimate the population of a given plant species within a study plot)		
	• research information related to a given issue (e.g., conduct an electronic search for information on factors that affect the reproduction and survival of wood frogs)		

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Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• identify strengths and weaknesses of different ways of displaying data (e.g., compare different ways of recording and displaying data on plant variation in a study plot)		
	• interpret patterns and trends in data, and infer and explain relationships among the variables (e.g., interpret data on changing animal populations, and infer possible causes)		
	• apply given criteria for evaluating evidence and sources of information (e.g., evaluate sources based on their currency, credibility and the extent to which claims are supported by data)		
	• 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	• 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., illustrate and compare methods of reproduction in sample organisms studied)		
	• evaluate individual and group processes used in investigating an issue and evaluating alternative decisions (e.g., evaluate strategies for locating information, such as the use of particular key words or search tools; evaluate approaches for sharing work on a given research task and for synthesizing the information found)		
	• defend a given position on an issue, based on their findings (e.g., defend a position on a proposed measure to protect a particular plant or animal population)		
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	ow interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., select and explore media on topics related to species diversity; express interest in hobbies and careers that involve the care, culture and study of living things)		
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness that the scientific study of changing animal and plant populations can arise from a variety of global needs, involving many individuals and organizations)		

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Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., strive to assess a problem accurately by careful analysis of evidence gathered; critically consider ideas and perceptions, recognizing that the obvious is not always right)		
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; accept various roles within a group, including that of leader)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., consider implications of changing land use on the welfare and survival of living things; identify potential conflicts between attempting to meet the wants and needs of humans and, at the same time, providing life-supporting environments for all living things; minimize environmental impact during studies by avoiding sampling that will affect an animal or plant population)		
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., follow safety procedures in outdoor investigations)		
UNIT B: MATTER AND CHEMICAL CHANGE *FALL (MID OCTOBER/NOVEMBER)			
SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY			
1. Investigate materials, and describe them in terms of their physical and chemical properties	• **investigate and describe properties of materials (e.g., investigate and describe the melting point, solubility and conductivity of materials observed)**		
	• **describe and apply different ways of classifying materials based on their composition and properties, including: – distinguishing between pure substances, solutions and mechanical mixtures**		**Explore real life applications including cleaning agents for home, food and drinks, characterists of metals found in daily life situations (plumbing, framing)**
	• **identify conditions under which properties of a material are changed, and critically evaluate if a new substance has been produced**		

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2. Describe and interpret patterns in chemical reactions	• **identify and evaluate dangers of caustic materials and potentially explosive reactions**		
	• **observe and describe evidence of chemical change in reactions between familiar materials, by:** **– describing combustion, corrosion and other reactions involving oxygen** **– observing and inferring evidence of chemical reactions between familiar household materials**		**Examples of outdoor cooking, preparation of meat, rust of metals (cars); tanning hides**
	• **distinguish between materials that react readily and those that do not (e.g., compare reactions of different metals to a dilute corrosive solution)**		
	• **observe and describe patterns of chemical change, by:** **– observing heat generated or absorbed in chemical reactions, and identifying examples of exothermic and endothermic reactions** **– identifying conditions that affect rates of reactions (e.g., investigate and describe how factors such as heat, concentration, surface area and electrical energy can affect a chemical reaction)** **– identifying evidence for conservation of mass in chemical reactions, and demonstrating and describing techniques by which that evidence is gathered**		
3. Describe ideas used in interpreting the chemical nature of matter, both in the past and present, and identify example evidence that has contributed to the development of these ideas	• **demonstrate understanding of the origins of the periodic table, and relate patterns in the physical and chemical properties of elements to their positions in the periodic table—focusing on the first 18 elements**		**Examine how the first 18 elements on the periodic table are infused in traditional Indigenous culture.** **- Elements that make up water, earth, fire.**
	• distinguish between observation and theory, and provide examples of how models and theoretical ideas are used in explaining observations (e.g., describe how observations of electrical properties of materials led to ideas about electrons and protons; describe how observed differences in the densities of materials are explained, in part, using ideas about the mass of individual atoms)		

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3. Describe ideas used in interpreting the chemical nature of matter, both in the past and present, and identify example evidence that has contributed to the development of these ideas (continued)	• **use the periodic table to identify the number of protons, electrons and other information about each atom; and describe, in general terms, the relationship between the structure of atoms in each group and the properties of elements in that group (e.g., use the periodic table to determine that sodium has 11 electrons and protons and, on average, about 12 neutrons; infer that different rows (periods) on the table reflect differences in atomic structure; interpret information on ion charges provided in some periodic tables) [Note: Knowledge of specific orbital structures for elements and groups of elements is not required at this grade level.]**		
	• **distinguish between ionic and molecular compounds, and describe the properties of some common examples of each**		**Use of household items such as salt, water, the process of drying of meat/ fish, Pipe Ceremony and tools.(Pipe is a molecular compound)**
4. Apply simplified chemical nomenclature in describing elements, compounds and chemical reactions	• **read and interpret chemical formulas for compounds of two elements, and give the IUPAC (International Union of Pure and Applied Chemistry) name and common name of these compounds (e.g., give, verbally and in writing, the name for NaCl(s) (sodium chloride), CO2(g) (carbon dioxide), MgO(s) (magnesium oxide), NH3(g) (nitrogen trihydride or ammonia), CH4(g) (carbon tetrahydride or methane), FeCl2(s) (iron(II) chloride), FeCl3(s) (iron(III) chloride)**		
	• **identify/describe chemicals commonly found in the home, and write the chemical symbols (e.g., table salt [NaCl(s)], water [H2O(l)], sodium hydroxide [NaOH(aq)] used in household cleaning supplies)**		**Add Cree words for the commonly found chemicals as well Example: Water, H2O, Nipiy**
	• **identify examples of combining ratios/number of atoms per molecule found in some common materials, and use information on ion charges to predict combining ratios in ionic compounds of two elements (e.g., identify the number of atoms per molecule signified by the chemical formulas for CO(g) and CO2(g); predict combining ratios of iron and oxygen based on information on ion charges of iron and oxygen)**		

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4. Apply simplified chemical nomenclature in describing elements, compounds and chemical reactions (continued)	• **assemble or draw simple models of molecular and ionic compounds (e.g., construct models of some carbon compounds using toothpicks, peas and cubes of potato) [Note: Diagrams and models should show the relative positions of atoms. Diagrams of orbital structures are not required at this grade level.]**		
	• **describe familiar chemical reactions, and represent these reactions by using word equations and chemical formulas and by constructing models of reactants and products (e.g., describe combustion reactions, such as: carbon + oxygen → carbon dioxide [C(s) + O2(g) → CO2(g)]; describe corrosion reactions, such as: iron + oxygen → iron(II) oxide [Fe(s) + O2(g) → FeO(s)]; describe replacement reactions, such as the following: zinc + copper(II) sulfate → zinc sulfate + copper [Zn(s) + CuSO4(aq) → ZnSO4(aq) + Cu(s)])** • **[Note 1: This outcome does not require students to explain the formation of polyatomic ions. Some chemicals with polyatomic ions may nevertheless be introduced; e.g., a brief introduction to CuSO4(s), ZnSO4(s) and H2SO4(aq) can help prepare students for further study of these materials in units C and D.] [Note 2: At this grade level, students are not required to balance reactants and products in chemical equations. Teachers may want to inform students about opportunities for further study of chemistry in Science 10 and in Science 14–24.]**		
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 questions about the reactivity of particular materials or about conditions that affect the rate of reaction, after observing that materials react at different rates)		
	• define and delimit questions and problems to facilitate investigation (e.g., reframe a general question, such as: "What affects the speed of reactions?" to become one or more specific questions, such as: "How will temperature affect the rate of reaction between materials x and y?" or "How will moisture affect the rate of reaction between x and y?")		
	• state a prediction and a hypothesis based on background information or an observed pattern of events		
	• select appropriate methods and tools for collecting data and information and for solving problems (e.g., plan and conduct a search for information about chemical elements, using appropriate print and electronic sources)		

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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., investigate the effect of particle size on a chemical reaction, taking care to identify and control other potentially relevant variables)		
	• observe and record data, and prepare simple drawings (e.g., represent a molecule studied through a drawing)		
	• **demonstrate knowledge of WHMIS standards, by using proper techniques for handling and disposing of laboratory materials**		
	• research information relevant to a given question (e.g., research properties of materials)		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs, line graphs and scatterplots (e.g., present data on different chemical substances in a form that facilitates interpretation)		
	• **calculate theoretical values of a variable (e.g., predict the total mass of the products of a chemical reaction, based on the mass of the reactants used) [Note: In this example, students can apply the law of conservation of mass.]**		
	• identify and suggest explanations for discrepancies in data		
	• state a conclusion, based on experimental data, and explain how evidence gathered supports or refutes an initial idea		
	• identify new questions and problems that arise from what was learned (e.g., identify new questions, such as: "Why do different compounds containing the same elements behave differently?" or "How do atoms stick together in a molecule?")		
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., follow given safety procedures)		
	• evaluate individual and group processes used in planning and carrying out investigative tasks (e.g., evaluate the relative success and scientific merits of different approaches to drawing and making models of molecules)		

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	SPECIFIC OUTCOMES FOR ATTITUDES		
Interest in Science	Show interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., express a degree of satisfaction at understanding science concepts that are challenging)		
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show an interest in the contributions that women and men— from many cultural backgrounds and different times—have made to the development of modern science; recognize that work done to investigate chemical properties and to develop models are both important steps toward scientific understanding		
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 during investigations and before drawing conclusions; honestly report and record all observations, even when the evidence is unexpected)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., demonstrate interest and become involved in decision making that requires full-group participation; assume responsibility for their share of the work to be done; work with other individuals)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., recognize that the materials people develop may have environmental consequences when people dispose of them; participate in school projects that address a chemical pollution issue)		
Safety	Show concern for safety in planning, carrying out and reviewing activities (e.g., read the labels of materials before using them, and ask for help if safety symbols are not clear or understood; carefully manipulate materials, using skills learned in class; wear proper safety attire without having to be reminded; ensure the proper disposal of materials; readily alter a procedure to ensure the safety of members of the group; immediately advise the teacher of spills, and use appropriate techniques and materials to clean up)		

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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.

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	UNIT C: ENVIRONMENTAL CHEMISTRY		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things	• **identify common organic and inorganic substances that are essential to the health and growth of humans and other living things, and illustrate the roles served by these substances (e.g., identify calcium as an essential material for bones; identify minerals that are known to enhance plant growth but that limit growth if too little or too much is available)**		**Sage and sweetgrass for medicinal purpose, mint and berry (vitamins), fish, moose and other animals (protein) that are consumed by humans**
	• **describe, in general terms, the forms of organic matter synthesized by plants and animals, including carbohydrates, proteins and lipids**		**Focus on local plants and animals**
	• **describe and illustrate processes by which chemicals are introduced to the environment or their concentrations are changed (e.g., dilution in streams, biomagnification through food chains)**		**Refer to Grade 7 Unit B for affects of pesticides being used and absorbed into ground water**
	• **describe the uptake of materials by living things through ingestion or absorption, and investigate and describe evidence that some materials are difficult for organisms to break down or eliminate (e.g., DDT, mercury)**		**Animals within the past few decades are contracting more cancer instances than before because of the concentration of chemicals in the ground due to human activity**

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1. Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things (continued)	• **identify questions that may need to be addressed in deciding what substances—in what amounts—can be safely released into the environment (e.g., identify questions and considerations that may be important in determining how much phosphate can be released into river water without significant harm to living things)**	❄	**Possible topic of oil industry**
2. Identify processes for measuring the quantity of different substances in the environment and for monitoring air and water quality	• **identify substrates and nutrient sources for living things within a variety of environments**		**Focus on local plants and animals**
	• **describe and illustrate the use of biological monitoring as one method for determining environmental quality (e.g., assess water quality, by observing the relative abundance of various vertebrate and invertebrate species)**		**Inquiry: Are there ways the elders can tell when the water is not healthy? Animals can tell?**
	• **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**
	• apply and interpret measures of chemical concentration in parts per million, billion or trillion		
	• **identify acids, bases and neutral substances, based on measures of their pH (e.g., use indicator solutions or pH meters to measure the pH of water samples)**		**Take PH of water from different locations (lake, stream, tap) as well as household items, soil.**
	• **investigate, safely, and describe the effects of acids and bases on each other and on other substances (e.g., investigate and describe the reaction that results when baking powder is dissolved; describe the role of acids and bases in neutralizing each other)**		**Method of tanning hides using the acid of the animal brains to aid in process.**
	• **describe effects of acids and bases on living things (e.g., acid rain in lakes, antacids for upset stomachs, pH in shampoos and conditioners)**		
3. Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment	• **describe mechanisms for the transfer of materials through air, water and soil; and identify factors that may accelerate or retard distribution (e.g., wind speed, soil porosity)**		**Use the local environment for examples**
	• describe mechanisms for biodegradation, and interpret information on the biodegradability of different materials		

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3. Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment (continued)	• comprehend information on the biological impacts of hazardous chemicals on local and global environments, by: – interpreting evidence for environmental changes in the vicinity of a substance release – interpreting LD50 data and other information on toxicity [Note: LD50 refers to the amount of a substance found to be lethal to 50% of a population, if ingested.] – identifying concerns with the disposal of domestic wastes, such as paints and oils, and industrial wastes	❄	
	• describe and evaluate methods used to transport, store and dispose of hazardous household chemicals		
	• **investigate and evaluate potential risks resulting from consumer practices and industrial processes, and identify processes used in providing information and setting standards to manage these risks (e.g., interpret and explain the significance of manufacturer's information on how wood preservatives can be safely applied; recognize that some individuals may have greater sensitivity to particular chemical substances than do others in the general population)**		**Investigate oil company regulations, building material regulations for homes or buildings**
	• identify and evaluate information and evidence related to an issue in which environmental chemistry plays a major role (e.g., evaluate evidence that the use of insecticides to control mosquitoes has an effect/has no effect on bird populations)		
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 (e.g., identify issues regarding the use of soil fertilizers)	❄	
	• identify questions arising from practical problems and issues (e.g., ask questions about the needs of different living things for nutrients and about the mechanisms by which these nutrients are obtained)		

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)	• state a prediction and a hypothesis about the concentration or dispersal of a chemical substance within an environment (e.g., state a hypothesis that relates the amount of oxygen in a local water sample to the presence or absence of dissolved nutrients)	❄	
	• select appropriate methods and tools for collecting data and information and for solving problems (e.g., design an investigation to compare the chemical characteristics of two soils)		
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• identify data and information that are relevant to the issue		
	• select and integrate information that is relevant to the issue (e.g., demonstrate proficiency in uploading and downloading text, image, audio and video files)		
	• use instruments and materials effectively and accurately for collecting data (e.g., measure and compare the pH in household products, foods and environments)		
	• 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 strengths and weaknesses of different ways of displaying data		
	• identify and suggest explanations for discrepancies in data (e.g., identify possible reasons for variation in the measured concentration of a chemical, where one sample is very different from others or where one group has a very different result from others)		
	• identify the line of best fit on a scatterplot, and interpolate or extrapolate based on the line of best fit (e.g., interpret class data on the effects of acidity on mould growth, graph the data, prepare a line of best fit, and predict the amount of growth that might be expected at different acidity values)		
	• apply given criteria for evaluating evidence and sources of information (e.g., use scatterplot data in evaluating how strong a relationship exists between two variables; evaluate claims of environmental impacts, based on the scope and relevance of supporting evidence)		
	• identify new questions and problems that arise from what was learned		

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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	• work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise • receive, understand and act on the ideas of others (e.g., seek and achieve group consensus on procedures to be used in an investigative activity, and act on that consensus) • defend a given position on an issue or problem, based on their findings (e.g., provide a clear rationale for a choice between alternative chemical products in a consumer application)	❄	
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., actively participate in extracurricular activities, such as science fairs, science clubs, or science and technology challenges)	❄	
Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., consider more than one perspective when formulating conclusions, solving problems or making decisions on environmental quality issues)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., consider observations and ideas from a number of sources during investigations and before drawing conclusions; strive to assess a problem or situation accurately, by careful analysis of evidence gathered)		
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)		
Stewardship	Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., show respect for all forms of life; modify their behaviour in light of an issue related to conservation and protection of the environment; recognize that the materials people use may have environmental consequences when people dispose of them)		

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
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; use safety precautions without being reminded)		
UNIT D: ELECTRICAL PRINCIPLES AND TECHNOLOGIES *LATE WINTER/EARLY SPRING			
SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY			
1. Investigate and interpret the use of devices to convert various forms of energy to electrical energy, and electrical energy to other forms of energy	• **identify, describe and interpret examples of mechanical, chemical, thermal, electrical and light energy**		*** Stories of Thunder Birds (transition of winter to spring) - electrical energy * Hunting methods - mechanical energy * Fire - chemical energy * From Sun - light energy**
	• **investigate and describe evidence of energy transfer and transformation (e.g., mechanical energy transformed into electrical energy, electrical energy transferred through power grids, chemical energy converted to electrical energy and then to light energy in a flashlight, thermal energy converted to electrical energy in a thermocouple)**		
	• investigate and evaluate the use of different electrodes, electrolytes and electrolytic concentrations in designing electrical storage cells		
	• **construct, use and evaluate devices for transforming mechanical energy into electrical energy and for transforming electrical energy into mechanical energy**		
	• **modify the design of an electrical device, and observe and evaluate resulting changes (e.g., investigate the effect of changes in the orientation and placement of magnets, commutator and armature in a St. Louis motor or in a personally-built model of a motor)**		

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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
2. Describe technologies for transfer and control of electrical energy	• **assess the potential danger of electrical devices, by referring to the voltage and current rating (amperage) of the devices; and distinguish between safe and unsafe activities**		
	• **distinguish between static and current electricity, and identify example evidence of each**		
	• **identify electrical conductors and insulators, and compare the resistance of different materials to electric flow (e.g., compare the resistance of copper wire and nickel-chromium/Nichrome wire; investigate the conduction of electricity through different solutions; investigate applications of electrical resistance in polygraph or lie detector tests)**		
	• **use switches and resistors to control electrical flow, and predict the effects of these and other devices in given applications (e.g., investigate and describe the operation of a rheostat)**		
	• **describe, using models, the nature of electrical current; and explain the relationship among current, resistance and voltage (e.g., use a hydro-flow model to explain current, resistance and voltage)**		
	• **measure voltages and amperages in circuits (e.g., determine the resistance in a circuit with a dry cell and miniature light; determine the resistances of copper, nickel-chromium/ Nichrome wire, pencil graphite and salt solution) – apply Ohm's law to calculate resistance, voltage and current in simple circuits**		
	• **develop, test and troubleshoot circuit designs for a variety of specific purposes, based on low voltage circuits (e.g., develop and test a device that is activated by a photoelectric cell; develop a model hoist that will lift a load to a given level, then stop and release its load; test and evaluate the use of series and parallel circuits for wiring a set of lights)**		
	• **investigate toys, models and household appliances; and draw circuit diagrams to show the flow of electricity through them (e.g., safely dismantle discarded devices, such as heating devices or motorized toys, and draw diagrams to show the loads, conductors and switching mechanisms)**		
	• identify similarities and differences between microelectronic circuits and circuits in a house (e.g., compare switches in a house with transistors in a microcircuit)		

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. Identify and estimate energy inputs and outputs for example devices and systems, and evaluate the efficiency of energy conversions	• **identify the forms of energy inputs and outputs in a device or system**		**Comparison of fire energy (energy input) used for smoking meat/fish with other forms of energy output.**
	• **apply appropriate units, measures and devices in determining and describing quantities of energy transformed by an electrical device, by:** **– measuring amperage and voltage, and calculating the number of watts consumed by an electrical device, using the formula P = IV [power (in watts) = current (in amps) × voltage (in volts)]** **– calculating the quantity of electric energy, in joules, transformed by an electrical device, using the formula E = P × t [energy (in joules) = power (in watts) × time (in seconds)]**		
	• **the concepts of conservation of energy and efficiency to the analysis of energy devices (e.g., identify examples of energy dissipation in the form of heat, and describe the effect of these losses on useful energy output)**		**Examples could include comparing energy dissipation of fire in different locations (outdoors in the open, with shelter block or in a fireplace)**
	• **compare energy inputs and outputs of a device, and calculate its efficiency, using the formula, percent efficiency = energy output/energy input × 100 (e.g., compare the number of joules of energy used with the number of joules of work produced, given information on electrical consumption and work output of a motor-driven device)**		**Use examples of hunting, building tools, making traditional clothing to show the utility of energy inputs and outputs**
	• investigate and describe techniques for reducing waste of energy in common household devices (e.g., by eliminating sources of friction in mechanical components, using more efficient forms of lighting, reducing overuse of appliances as in "overdrying" of clothes)		
4. Describe and discuss the societal and environmental implications of the use of electrical energy	• **identify and evaluate sources of electrical energy, including oil, gas, coal, biomass, wind and solar (e.g., identify and evaluate renewable and nonrenewable sources for generating electricity; evaluate the use of batteries as an alternative to internal combustion engines)**		**Focus on local renewable and nonrenewable sources and stewardship**
	• describe the by-products of electrical generation and their impacts on the environment (e.g., identify by-products and potential impacts of coal-fired electricity generation)		

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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
4. Describe and discuss the societal and environmental implications of the use of electrical energy (continued)	• identify example uses of electrical technologies, and evaluate technologies in terms of benefits and impacts (e.g., identify benefits and issues related to the use of electrical technologies for storing and transmitting personal information)		
	• identify concerns regarding conservation of energy resources, and evaluate means for improving the sustainability of energy use		
SPECIFIC OUTCOMES FOR SKILLS			
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• propose alternative solutions to a given practical problem, select one, and develop a plan		
	• identify questions to investigate arising from practical problems and issues (e.g., identify questions, such as: "How can the amount of electric current in a circuit be controlled?")		
	• rephrase questions in a testable form, and clearly define practical problems (e.g., rephrase questions, such as: "Why do we use parallel circuits rather than series circuits in household wiring?" to become "How do series circuits and parallel circuits respond differently under load?")		
	• state a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict the amount of current in a circuit of known resistance and applied voltage)		
	• formulate operational definitions of major variables in the study of electrical circuits (e.g., provide operational definitions for current, resistance, voltage, polarity)		
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• use tools and apparatus safely (e.g., use appropriate sources of electrical energy, and follow procedures to ensure personal and group safety)		
	• estimate measurements (e.g., estimate the efficiency of a mechanical device)		
	• use instruments effectively and accurately for collecting data (e.g., use ammeters and voltmeters)		

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
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• test the design of a constructed device or system		
	• evaluate designs and prototypes in terms of function, reliability, safety, efficiency, use of materials and impact on the environment (e.g., evaluate the safety, durability, efficiency and environmental impact of a personally-constructed wet cell design)		
	• identify and correct practical problems in the way a prototype or constructed device functions		
	• identify and suggest explanations for discrepancies in data (e.g., measure the current in similar circuits, and provide possible explanations for differences in current flow)		
	• identify potential sources of error, and determine the amount of error in a given measurement (e.g., identify the precision of voltmeters and ammeters used to measure current flow)		
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• 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., use charts to present data on the voltage, current (amperage) and resistance found in series and parallel circuits)		
	• defend a given position on an issue or problem based on their findings (e.g., develop and defend a proposal on the appropriateness of an alternative energy source in a given application)		
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., actively participate in extracurricular activities, such as science fairs or science and technology challenges; pursue a science- or technology-related hobby; choose to investigate topics related to electrical technologies)		

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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
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 scientific thinking, craftsmanship and collaborative effort that goes into the development of electrical devices and systems)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., strive to assess a problem or situation accurately, by careful analysis of evidence gathered; ask questions to clarify meaning or confirm their understanding; report the limitations of their designs; continue working on a problem or research project until the best possible solutions or answers are found)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., demonstrate interest and become involved in decision making that requires full-group participation; consider alternative ideas and interpretations 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., 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 in using electrical devices; readily alter a procedure to ensure the safety of members of the group; stay at their own work area during an activity, respecting others' space, materials and work)		

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: ELECTRICAL PRINCIPLES AND TECHNOLOGIES ***LATE WINTER/EARLY SPRING**		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Investigate and interpret the use of devices to convert various forms of energy to electrical energy, and electrical energy to other forms of energy	• **identify, describe and interpret examples of mechanical, chemical, thermal, electrical and light energy**		*** Stories of Thunder Birds (transition of winter to spring) - electrical energy** *** Hunting methods - mechanical energy** *** Fire - chemical energy** *** From Sun - light energy**
	• **investigate and describe evidence of energy transfer and transformation (e.g., mechanical energy transformed into electrical energy, electrical energy transferred through power grids, chemical energy converted to electrical energy and then to light energy in a flashlight, thermal energy converted to electrical energy in a thermocouple)**		
	• investigate and evaluate the use of different electrodes, electrolytes and electrolytic concentrations in designing electrical storage cells		

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
1. Investigate and interpret the use of devices to convert various forms of energy to electrical energy, and electrical energy to other forms of energy (continued)	• **construct, use and evaluate devices for transforming mechanical energy into electrical energy and for transforming electrical energy into mechanical energy**		
	• **modify the design of an electrical device, and observe and evaluate resulting changes (e.g., investigate the effect of changes in the orientation and placement of magnets, commutator and armature in a St. Louis motor or in a personally-built model of a motor)**		
2. Describe technologies for transfer and control of electrical energy	• **assess the potential danger of electrical devices, by referring to the voltage and current rating (amperage) of the devices; and distinguish between safe and unsafe activities**		
	• **distinguish between static and current electricity, and identify example evidence of each**		
	• **identify electrical conductors and insulators, and compare the resistance of different materials to electric flow (e.g., compare the resistance of copper wire and nickel-chromium/Nichrome wire; investigate the conduction of electricity through different solutions; investigate applications of electrical resistance in polygraph or lie detector tests)**		
	• **use switches and resistors to control electrical flow, and predict the effects of these and other devices in given applications (e.g., investigate and describe the operation of a rheostat)**		
	• **describe, using models, the nature of electrical current; and explain the relationship among current, resistance and voltage (e.g., use a hydro-flow model to explain current, resistance and voltage)**		
	• **measure voltages and amperages in circuits (e.g., determine the resistance in a circuit with a dry cell and miniature light; determine the resistances of copper, nickel-chromium/ Nichrome wire, pencil graphite and salt solution) – apply Ohm's law to calculate resistance, voltage and current in simple circuits**		
	• **develop, test and troubleshoot circuit designs for a variety of specific purposes, based on low voltage circuits (e.g., develop and test a device that is activated by a photoelectric cell; develop a model hoist that will lift a load to a given level, then stop and release its load; test and evaluate the use of series and parallel circuits for wiring a set of lights)**		

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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
2. Describe technologies for transfer and control of electrical energy (continued)	• **investigate toys, models and household appliances; and draw circuit diagrams to show the flow of electricity through them (e.g., safely dismantle discarded devices, such as heating devices or motorized toys, and draw diagrams to show the loads, conductors and switching mechanisms)**		
	• identify similarities and differences between microelectronic circuits and circuits in a house (e.g., compare switches in a house with transistors in a microcircuit)		
3. Identify and estimate energy inputs and outputs for example devices and systems, and evaluate the efficiency of energy conversions	• **identify the forms of energy inputs and outputs in a device or system**		**Comparison of fire energy (energy input) used for smoking meat/fish with other forms of energy output.**
	• **apply appropriate units, measures and devices in determining and describing quantities of energy transformed by an electrical device, by:** **– measuring amperage and voltage, and calculating the number of watts consumed by an electrical device, using the formula P = IV [power (in watts) = current (in amps) × voltage (in volts)]** **– calculating the quantity of electric energy, in joules, transformed by an electrical device, using the formula E = P × t [energy (in joules) = power (in watts) × time (in seconds)]**		
	• **the concepts of conservation of energy and efficiency to the analysis of energy devices (e.g., identify examples of energy dissipation in the form of heat, and describe the effect of these losses on useful energy output)**		**Examples could include comparing energy dissipation of fire in different locations (outdoors in the open, with shelter block or in a fireplace)**
	• **compare energy inputs and outputs of a device, and calculate its efficiency, using the formula, percent efficiency = energy output/energy input × 100 (e.g., compare the number of joules of energy used with the number of joules of work produced, given information on electrical consumption and work output of a motor-driven device)**		**Use examples of hunting, building tools, making traditional clothing to show the utility of energy inputs and outputs**
	• investigate and describe techniques for reducing waste of energy in common household devices (e.g., by eliminating sources of friction in mechanical components, using more efficient forms of lighting, reducing overuse of appliances as in "overdrying" of clothes)		

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. Describe and discuss the societal and environmental implications of the use of electrical energy	• **identify and evaluate sources of electrical energy, including oil, gas, coal, biomass, wind and solar (e.g., identify and evaluate renewable and nonrenewable sources for generating electricity; evaluate the use of batteries as an alternative to internal combustion engines)**		**Focus on local renewable and nonrenewable sources and stewardship**
	• describe the by-products of electrical generation and their impacts on the environment (e.g., identify by-products and potential impacts of coal-fired electricity generation)		
	• identify example uses of electrical technologies, and evaluate technologies in terms of benefits and impacts (e.g., identify benefits and issues related to the use of electrical technologies for storing and transmitting personal information)		
	• identify concerns regarding conservation of energy resources, and evaluate means for improving the sustainability of energy use		
SPECIFIC OUTCOMES FOR SKILLS			
Initiating and Planning Ask questions about the relationships between and among observable variables, and plan investigations to address those questions	• propose alternative solutions to a given practical problem, select one, and develop a plan		
	• identify questions to investigate arising from practical problems and issues (e.g., identify questions, such as: "How can the amount of electric current in a circuit be controlled?")		
	• rephrase questions in a testable form, and clearly define practical problems (e.g., rephrase questions, such as: "Why do we use parallel circuits rather than series circuits in household wiring?" to become "How do series circuits and parallel circuits respond differently under load?")		
	• state a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict the amount of current in a circuit of known resistance and applied voltage)		
	• formulate operational definitions of major variables in the study of electrical circuits (e.g., provide operational definitions for current, resistance, voltage, polarity)		

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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
Performing and Recording Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data	• use tools and apparatus safely (e.g., use appropriate sources of electrical energy, and follow procedures to ensure personal and group safety)		
	• estimate measurements (e.g., estimate the efficiency of a mechanical device)		
	• use instruments effectively and accurately for collecting data (e.g., use ammeters and voltmeters)		
Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• test the design of a constructed device or system		
	• evaluate designs and prototypes in terms of function, reliability, safety, efficiency, use of materials and impact on the environment (e.g., evaluate the safety, durability, efficiency and environmental impact of a personally-constructed wet cell design)		
	• identify and correct practical problems in the way a prototype or constructed device functions		
	• identify and suggest explanations for discrepancies in data (e.g., measure the current in similar circuits, and provide possible explanations for differences in current flow)		
	• identify potential sources of error, and determine the amount of error in a given measurement (e.g., identify the precision of voltmeters and ammeters used to measure current flow)		
Communication and Teamwork Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results	• 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., use charts to present data on the voltage, current (amperage) and resistance found in series and parallel circuits)		
	• defend a given position on an issue or problem based on their findings (e.g., develop and defend a proposal on the appropriateness of an alternative energy source in a given application)		

The Essential Learning Outcomes (ELOs) identified in these charts by the KTCEA working group are based on **their local context**. An educational authority from a different region of Alberta may identify different ELOs, based on their context. All outcomes in Alberta Education's Program of Studies must be taught, but what is deemed essential will look different, based on context.

Big Idea, Major Concepts, GLOs SPECIFIC OUTCOMES FOR ATTITUDES	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
Interest in Science	Show interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., actively participate in extracurricular activities, such as science fairs or science and technology challenges; pursue a science- or technology-related hobby; choose to investigate topics related to electrical technologies)		
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 scientific thinking, craftsmanship and collaborative effort that goes into the development of electrical devices and systems)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., strive to assess a problem or situation accurately, by careful analysis of evidence gathered; ask questions to clarify meaning or confirm their understanding; report the limitations of their designs; continue working on a problem or research project until the best possible solutions or answers are found)		
Collaboration	Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., demonstrate interest and become involved in decision making that requires full-group participation; consider alternative ideas and interpretations 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., 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 in using electrical devices; readily alter a procedure to ensure the safety of members of the group; stay at their own work area during an activity, respecting others' space, materials and work)		

The Essential Learning Outcomes (ELOs) identified in these charts by the KTCEA working group are based on **their local context**. An educational authority from a different region of Alberta may identify different ELOs, based on their context. All outcomes in Alberta Education's Program of Studies must be taught, but what is deemed essential will look different, based on context.

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 E: SPACE EXPLORATION		
	SPECIFIC OUTCOMES FOR SCIENCE, TECHNOLOGY AND SOCIETY		
1. Investigate and describe ways that human understanding of Earth and space has depended on technological development	• **identify different ideas about the nature of Earth and space, based on culture and science (e.g., compare geocentric and heliocentric models [Note: knowledge of epicycles is not required]; describe Aboriginal views of space and those of other cultures; describe the role of observation in guiding scientific understanding of space)**		**Describe Aboriginal views of space. Ask Elders for Sky Woman (Sky Woman Falling) and creation/ cosmology stories**
	• investigate and illustrate the contributions of technological advances —including optical telescopes, spectral analysis and space travel —to a scientific understanding of space		
	• describe, in general terms, the distribution of matter in star systems, galaxies, nebulae and the universe as a whole		
	• identify evidence for, and describe characteristics of, bodies that make up the solar system; and compare their composition and characteristics with those of Earth		
	• describe and apply techniques for determining the position and motion of objects in space, including: – constructing and interpreting drawings and physical models that illustrate the motion of objects in space (e.g., represent the orbit of comets around the Sun, using a looped-string model) – describing in general terms how parallax and the Doppler effect are used to estimate distances of objects in space and to determine their motion – describing the position of objects in space, using angular coordinates (e.g., describe the location of a spot on a wall, by identifying its angle of elevation and its bearing or azimuth; describe the location of the Sun and other stars using altitude-azimuth coordinates, also referred to as horizon coordinates or local coordinates) [Note: A description of star positions based on right ascension and declination is not required.]		
	• investigate predictions about the motion, alignment and collision of bodies in space (e.g., investigate predictions about eclipses; identify uncertainties in predicting and tracking meteor showers)		

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2. Identify problems in developing technologies for space exploration, describe technologies developed for life in space, and explain the scientific principles involved	• analyze space environments, and identify challenges that must be met in developing life-supporting systems (e.g., analyze implications of variations in gravity, temperature, availability of water, atmospheric pressure and atmospheric composition)		
	• **describe technologies for life-support systems, and interpret the scientific principles on which they are based (e.g., investigate systems that involve the recycling of water and air)**		
	• describe technologies for space transport, and interpret the scientific principles involved (e.g., describe the development of multistage rockets, shuttles and space stations; build a model vehicle to explore a planet or moon)		
	• **identify materials and processes developed to meet needs in space, and identify related applications (e.g., medicines, remote sensing, microelectronics, polymers, medical imaging, wireless communication technologies, synthesis of fuels)**		
	• describe the development of artificial satellites, and explain the major purposes for which they are used (e.g., communication, GPS—global positioning system, weather observation)		
3. Describe and interpret the science of optical and radio telescopes, space probes and remote sensing technologies	• explain, in general terms, the operation of optical telescopes, including telescopes that are positioned in space environments		
	• explain the role of radio and optical telescopes in determining characteristics of stars and star systems		
	• **describe and interpret, in general terms, the technologies used in global positioning systems and in remote sensing (e.g., use triangulation to determine the position of an object, given information on the distance from three different points) [Note: This example involves the use of geometric approaches rather than mathematical calculations.]**		

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4. Identify issues and opportunities arising from the application of space technology, identify alternatives involved, and analyze implications	• **recognize risks and dangers associated with space exploration (e.g., space junk, fuel expenditure, satellites burning up in the atmosphere, solar radiation)**		**Stewardship of the earth and parallel the potential dangers of space ending up like the earth is - use of resources**
	• **describe Canadian contributions to space research and development and to the astronaut program (e.g., Canadarm)**		
	• identify and analyze factors that are important to decisions regarding space exploration and development (e.g., identify examples of costs and potential benefits that may be considered; investigate and describe political, environmental and ethical issues related to the ownership and use of resources in space)		
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 that must be addressed in developing a lifesupporting space environment)		
	• propose alternative solutions to a given practical problem, select one, and develop a plan (e.g., design and describe a model of a technology to be used in a space station)		
	• state a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict the next appearance of a comet, based on past observations; develop a hypothesis about the geologic history of a planet or its moon, based on recent data)		
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 (e.g., compile and compare information about two exploratory missions)		
	• organize data, using a format that is appropriate to the task or experiment (e.g., maintain a log of observed changes in the night sky; prepare a data table to compare various planets)		

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Analyzing and Interpreting Analyze qualitative and quantitative data, and develop and assess possible explanations	• test the design of a constructed device or system (e.g., create and test a model device for remote manipulation of materials)		
	• identify and correct practical problems in the way a prototype or constructed device functions (e.g., identify and correct problems in the functioning of a model "remote transportation device" that they have designed and built)		
	• identify the strengths and weaknesses of different methods of collecting and displaying data (e.g., compare Earth-based observations with those made from spacecraft)		
	• identify new questions and problems that arise from what was learned (e.g., identify questions to guide further investigation, such as: "What limits the travelling distance and duration of space exploration?", "How old are the planets, and how did they form?")		
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., take into account advice provided by other students or individuals in designing a model space suit or space vehicle)		
	• work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise (e.g., write and act out a skit to demonstrate tasks carried out by astronauts on a mission)		
	• defend a given position on an issue or problem, based on their findings (e.g., conduct appropriate research to justify their position on the economic costs or benefits of space exploration)		
SPECIFIC OUTCOMES FOR ATTITUDES			
Interest in Science	Show interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., express interest in and describe media programs on space science and technology; take an interest in directly observing and interpreting space environments and in personal and group excursions to a space science centre)		

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Mutual Respect	Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show an interest in the contributions that women and men from many cultural backgrounds have made to the development of modern science and technology)		
Scientific Inquiry	Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., seek accurate data that is 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., work with others to identify problems and explore possible solutions; share observations and ideas with other members of the 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)		

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