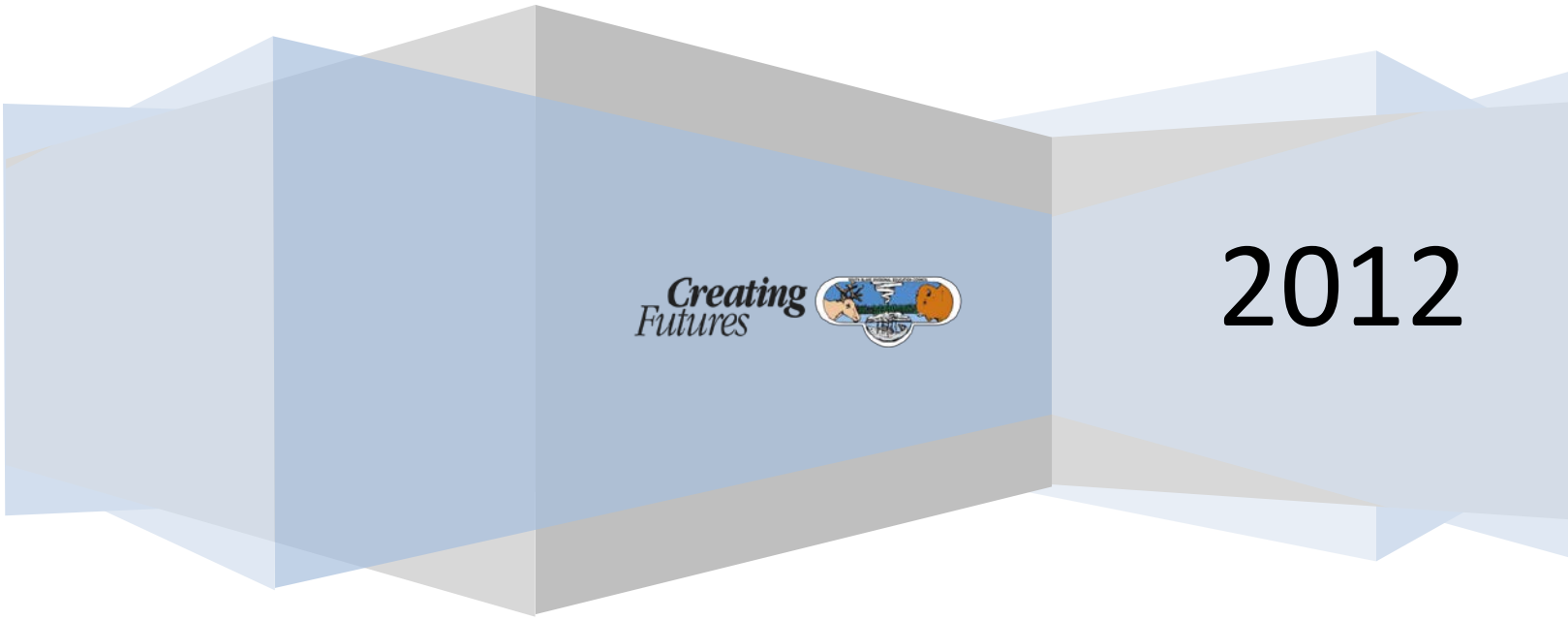
South Slave Divisional Education Council

SCIENCE GRADE 9

CURRICULUM PACKAGE

February 2012



2012

CONTENTS

Dene Kede

Dene Kede, the culture-based curriculum of the NWT, serves as the heart of the NWT Curriculum. Dene Kede was developed under the guidance of Dene elders and shares, through its teachings, the knowledge, skills, and values of the Dene. These cultural understandings serve as the underpinnings for all learning in all content areas and it is expected that the teachings and knowledge contained within Dene Kede shall be woven into all lessons. In this manner our students will become more capable, more successful and better able to *walk in two worlds.*

Passage to Manhood

Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Major Cultural Understanding: In the past, puberty for boys signified an important change.	
Discuss and understand that in the past, puberty for boys signified an important change.	• Puberty was marked with a change in the voice of a boy. • In times past, the Dene believed that young boys and girls gained spiritual power, as they became adolescents. • Passage into puberty began a period of intense training for young boys, in preparation for manhood.
Major Cultural Understanding: After puberty, boys began an intensive training for manhood.	
Describe ways after puberty, that boys began training for manhood.	• Training began when boys were very young but during adolescence it became very intensive and the expectations grew considerably. • The boys began to accompany the adult men on hunts. With the "first kill" of a young man Elders would tear at his clothing to celebrate the emergence of a provider and to remind him that there were those with whom he should share his catch. If the first kill was a large one, the whole community celebrated and the meat would be distributed to the Elders. • They learned to make and repair tools, they learned about time, direction and weather as it related to travelling. • They learned how to work with a leader in large hunts, cooperating to ensure success. • They were made to go off on hunting trips alone as a test of their knowledge and skills and mental stamina and courage. • When the young man proved capable and self-sufficient on the land, he was recognized as a man and allowed to marry
Major Cultural Understanding: Some tribes trained their boys in a separate camp during their passage.	
Describe and record how some tribes trained their boys in camps during their passage.	• The boys were put through a period of training away from others. • They were given rigorous challenges such as sleeping by sitting upright, or working without a break right after waking. • These challenges were meant to condition their bodies and to develop mental stamina.
Major Cultural Understanding: Some tribes engaged their young men in dream quests.	
Discuss what a Dream Quest might have been like for a young man	• Stories of dream quests were told to the young people from the time they were young so that they could look forward to the time that they would begin their own quests. • Even today, puberty signifies an important change in boys. • Dream quests were sacred spiritual experiences where the young men would receive dreams or visions, which communicated their medicine powers • Young men were encouraged to stay in the bush, away from others in order to enable dreams. • There were times that dreams did not come at all to boys, and other times when boys became old men before the dreams would come to them. There were powers, which existed only in the people who showed courage and concern
Major Cultural Understanding: As in the past, boys today can use the time of their passage to prepare themselves for manhood	
Discuss ways in which young man prepare today for manhood and record responses	• By knowing that the changes in their bodies signify the ability to father a child • By recognizing the spiritual possibilities within themselves and treating themselves with respect • By accepting and seeking the guidance of Elders and other men

Passage to Manhood

Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Major Cultural Understanding: Attitudes related to self development as a man	
Describe the most effective ways for men to develop to be active members of their families and communities	• Willingness to learn from the words of Elders • Willingness to reflect on one's decisions and behaviors • Willingness to accept and begin learning the roles and responsibilities of men in their families and their community
Major Cultural Understanding: Skills related to self development as a man	
Identify what skills would be important for a young man to know as he moved into adulthood	• Recognizing changes in one's body and the implications of these Caring for one's body • Personal goal setting • Seeking Elders for guidance • Seeking opportunities to learn the skills required for manhood
Major Cultural Understanding: Skills related to being a man in one's family and community	
Distinguish what it means to be a member of your current family; what does it mean to be a member of your community	• As determined by family and community

Spirit of the Land

Major Cultural Understanding: Dene spirituality is attached to the land.	
Cite and write stories about your Dene Spirituality	• Dene oral stories tell about when the world was new. • The Creator made the land and the animals fist and then made the people. • The Creator gave medicine powers to all people who lived good lives to use to help others to survive. These medicine powers were spirit powers from nature. • Spiritual brothers were sent to the earth to bring laws to the land and to people. These laws were meant to help the Dene so that we could live with the animal creatures and with each other more peacefully. • Messages have been left in the form of landmarks throughout our land to remind us of the sacredness of the land and the Dene laws which are to guide our lives.
Major Cultural Understanding: Dene prophets have seen the past and the future and have relayed messages about how to deal with the changes that are happening to the Dene.	
List examples of the ways in which the Dene prophets have seen the past and the future and have relayed messages about how to deal with the changes that are happening to the Dene. Describe how this knowledge is important in today's changing society	• The prophets are people who have received messages for the Dene people from the Creator. • The prophets have communicated that changes will put great pressures upon Dene. • Dene prophets have seen the past and the future and have relayed messages about how to deal with the changes that are happening to the Dene
Major Cultural Understanding: When missions and churches first arrived they tried to discourage the practice of Dene spirituality.	
Recall ways in which the missions and churches tried to discourage the practice of Dene spirituality.	• Each community has its own stories of how their Dene spirituality was discouraged. • Despite the pressures to abandon Dene spirituality, many of the beliefs have persisted and are accepted into many churches.
Major Cultural Understanding: Today, Dene people continue their spiritual ties to the land.	
Give examples of how the Dene people continue their spiritual ties to the land.	• Belief that without the land, life is not possible. • Belief that the land must be honoured and protected to ensure that it continues to sustain the people. • Belief that in honouring the land, the Creator is being honoured. • Belief in the ways of respect for the land: • Belief that medicine powers have diminished but exist in the form of talents among people.

Spirit of the Land

Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	• Belief that the Elders still living who have led spiritual lives have the most to teach about the spirit of the land. • Much of the spiritual knowledge of the Dene is passed from mentor to specially chosen students.
Major Cultural Understanding: Skills related to recognizing the spirit of the land	
Identify skills you will need to recognize the spirit of the land	• Honouring the spirit of the land in Dene ways • Seeking Elders for teachings and guidance
Major Cultural Understanding: Attitudes related to recognizing the spirit of the land	
Identify attitudes you will need to relate to the spirit of the land	• Willingness to reflect on one's feelings about the land • Willingness to show respect to the spirit of the land • Willingness to learn about the spirit of the land

Developing out Talents

Major Cultural Understanding: People are born with talents and these are sacred.	
Give examples of how people are born with special talents in your community	• Talents are gifts that come to individuals from the Creator. • Everyone is born with a talent but it must be discovered and developed. • A person's talents can be discovered when the person is very young.
Major Cultural Understanding: A person's talent must be discovered.	
Discuss ways students can identify personal talents and talents of those around them	• Things come easily to those with talent. • People in one's family may know the talents of the family members. • Elders are often able to see talents in the young. If the young are able to take the advice of Elders, they can discover the talents in themselves. • In the past young people were advised by Elders in their dream quests as they searched for their spiritual powers. • Elders with finely developed talents and wisdom were mentors for the young who showed talents in their areas
Major Cultural Understanding: An Individual should share their talent.	
Identify why and ways that people in your community should share their talents.	• Special talents and abilities are provided to individuals by the Creator in order for them to be shared. • Talents were meant by the Creator to help people survive and to live a better life. • Talents that are not shared are left unused (can't be shy or lazy). You receive back what you give away or share in the way of talents. • Individuals should not use talents for self-gain. One should not expect payment for the sharing of a talent. • Gifts should be offered in exchange for the sharing of talent in order to enable the person to maintain his or her talent.
Major Cultural Understanding: A person with talent is humble.	
Discuss why it is important that a person with talent remain humble.	• A person with talent must not boast of it or ridicule others who do not have it. • A person with talent does not speak of his talent. It is left to others to recognize and speak of the talent.
Major Cultural Understanding: Dene talents come in many forms.	
Discuss and identify the people in your community with talents.	• Some talents are closer to the Creator than other talents. • The Dene believe that certain activities are more spiritual in nature than others and when people have talents in these activities they are gifted with medicine powers and are considered very important people to the culture. Examples are midwifery, drumming and dancing. • Talents today come in other forms that are useful to our lives: talents such as being a good truck driver, being a good teacher or being a good mechanic.

Spirit of the Land

Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	• Some people are gifted with many talents. These people are encouraged to search for the one talent that they feel comfortable or easy with - that will be the one that was meant for them
Major Cultural Understanding: Attitudes related to the development of one's talent	
Identify ways in which you can develop and strengthen your own talents and share those talents with those around you	• Reflect on work habits relating to one's talent • Try new experiences and take opportunities to learn • Continually learn and develop skills to honour the talent • Spend time in the company of elders who can help in assessing one's strengths • Remain humble • Share one's talents with others • Seek an elder(s) for mentorship in the area of one's talent.
Major Cultural Understanding: Development of Dene Skills	
Continue personal development of Dene skills	• Developing Dene skills at increasing levels of complexity • Increasing individualization and creativity in work

Winter Camp

Major Cultural Understanding: Dene knowledge about winter weather and land conditions is important to successful and safe winter land use.

Describe the winter weather and land conditions and identify why it is important to understand conditions	• Use various weather indicators o Ice conditions, behaviors on lakes and rivers and o Implications for land use o Wind conditions and implications for land use o Snow variations and implications for land use o Temperature and implications for land use
Major Cultural Understanding: Dene knowledge of the winter hunting/fishing/ trapping area is important to successful and safe winter land use.	
Identify what knowledge about winter weather and land conditions is important to successful and safe winter land use.	• Locate trap line locations on a map • Locate geographical features, landmarks and spiritual sites o Potentially dangerous areas in winter o Historical land use information o Use of area in other seasons o Other resources in the area accessed by the Dene
Major Cultural Understanding: Dene knowledge about fur bearing animals is important for successful winter trapping.	
Identify what Dene knowledge about fur bearing animals is important for successful winter trapping.	• Fur bearing animals found in area • Life cycles, habitat and habits of fur bearing animals • Where and how best to set traps based on knowledge of their habits

Self Government

Major Cultural Understanding: In contrast to the accepted Canadian perspective of political change in the Northwest Territories, the Dene have their own perspective which is the basis for their struggle for Self Government

Compare and contrast the Canadian perspective of political change in the Northwest Territories, Identify the Dene perspective which is the basis for their struggle for Self Government	• The northern territory is considered hinterland: remote lands owned primarily for the purpose of exploiting of its resources. • The aboriginal people are considered just one of many ethnic groups making up the mosaic that is Canada. Settlers who have moved to the North have as much right to the land and how it is controlled as the First Nations people. • Treaties in the past were acknowledgments on the part of the Dene that they were extinguishing their aboriginal or First People's rights. • The Canadian constitution can only recognize and give powers to provinces. • To encourage political growth, the NWT is being prepared for provincial status.

Self Government

Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Major Cultural Understanding: The Dene has a tradition-based model of self-government.	
Identify and describe the Dene tradition-based model of self-government.	• Unity and cooperation within the group is valued. o Consensus style decision making: o Participants who spoke were only those who had earned the right to speak. Young people were seldom involved in decision making group. o When one spoke, one's words carried weight because one had earned the right to speak. The leader would take into consideration everything said and would suggest solutions or courses of action based on agreement of the whole group. o Once courses of action were agreed upon, there was no continuing disagreement or subversive activity. o Once the course of action was agreed upon, absolute adherence was expected. o Elders have the life experience and wisdom to know what is important in a leader. o Leadership requires support. o Leader had helpers to administer his leadership o The purpose of leadership and government was to ensure the survival of the group.
Major Cultural Understanding: The Dene are seeking Self Government as a way to control aspects of their lives that are most closely related to their survival as a people.	
Give examples of how the Dene are seeking Self Government as a way to control aspects of their lives that are most closely related to their survival as a people.	• By seeking political rights based on their status as a "nation" • By seeking a style of the political leadership based on Elder's council and consensus • By seeking to control the management and monitoring of land and water use: • By seeking to control economic development: • By seeking to control the social institutions:
Major Cultural Understanding: Successful Self Government will require Dene awareness and participation.	
Describe why it is important that Self Government requires Dene awareness and participation.	• Individual awareness of all the issues that have bearing on Dene lives • Active participation in discussions of issues and in decision-making
Major Cultural Understanding: Attitudes related to understanding Dene self-government.	
Identify what aattitudes are important to relate to understanding Dene self-government.	• Willingness to learn from the Dene their perspective on self-government
Major Cultural Understanding: Attitudes related to visualizing oneself in the future.	
Describe what attitudes are important for Dene to relate to visualizing oneself in the future	• Willingness to reflect on one's future and set goals for participation in Dene Self-Government

SCIENCE GRADE 9

Biological Diversity

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
ESSENTIAL QUESTIONS What is **biological diversity**, and by what processes do diverse living things pass on their characteristics to future generations? What impact does human activity have on biological diversity?	
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 • Identify examples of niches, and describe the role of variation in enabling closely related living things to survive in the same ecosystem • Investigate and interpret dependencies among species that link the survival of one species to the survival of others • Identify examples of symbiotic relationships • Classify symbiotic relationships as mutualism, commensalism, parasitism • Identify the role of variation in species survival under changing environmental conditions
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, • Describe examples of variation of characteristics within a species, and identify examples of both discrete and continuous variation • Investigate the transmission of characteristics from parents to offspring, and identify examples of characteristics in offspring • 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 • 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
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 & relationship of chromosomes, genes & 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 • Compare sexual and asexual reproduction, in terms of the advantages and disadvantages • Distinguish between, and identify examples of, natural and artificial selection • Describe, in simple terms, some genetic technologies; and identify questions and issues related to their application
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 • Describe ongoing changes in biological diversity through extinction and extirpation of native species, and investigate the role of environmental factors in causing these changes • Evaluate the success and limitations of various local and global strategies for minimizing loss of species diversity • Investigate and describe the use of biotechnology in environmental, agricultural or forest management; and identify potential impacts and issues

SCIENCE GRADE 9

Biological Diversity

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
SKILLS OUTCOMES: I on use of research and inquiry skills to inform the decision-making process **(embed throughout unit)**	
Initiating and Planning: Ask questions about the relationships between & among observable variables, and plan investigations to address questions	• Identify science-related issues • Identify questions to investigate arising from science-related issues • State a prediction and a hypothesis based on background information or an observed pattern of events • Define and delimit questions and problems to facilitate investigation
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 • Estimate measurements • Research information related to a given issue
Analyzing and Interpreting: Analyze qualitative and quantitative data, and develop and assess possible explanations	• Identify strengths and weaknesses of different ways of displaying data • Interpret patterns and trends in data, and infer and explain relationships among the variables • Apply given criteria for evaluating evidence and sources of information • 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 • Evaluate individual and group processes used in investigating an issue and evaluating alternative decisions • Defend a given position on an issue, based on their findings
ATTITUDE OUTCOMES (embed throughout unit)	
Scientific Inquiry: develop attitudes that support active inquiry, problem solving and decision making	• Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues
Collaboration: develop attitudes that support collaborative activity.	• Work collaboratively in carrying out investigations and in generating and evaluating ideas
Stewardship: develop responsibility in the application of science and technology in relation to society and the natural environment.	• Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment
Safety: demonstrate a concern for safety in science and technology contexts.	• Show concern for safety in planning, carrying out and reviewing activities

Matter and Chemical Change

ESSENTIAL QUESTIONS:

What are the properties of materials, and what happens to them during chemical change?
What evidence do we have of chemical change; and what ideas, theories or models help us explain that evidence?

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: o Distinguishing between pure substances, solutions and mechanical mixtures o Distinguishing between metals and non-metals *[note: metalloids may also be introduced at this level but are not required.]* o Identifying and applying other methods of classification

Matter and Chemical Change

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	• Identify conditions under which properties of a material are changed, and critically evaluate if a new substance has been produced
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: o Describing combustion, corrosion and other reactions involving oxygen o Observing and inferring evidence of chemical reactions between familiar household materials • 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: o Observing heat generated or absorbed in chemical reactions, and identifying examples of exothermic and endothermic reactions o 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)* o Identifying evidence for conservation of mass in chemical reactions, and demonstrating and describing techniques by which that evidence is gathered.
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	• 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 • 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)* • 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
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)*

Matter and Chemical Change

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
SKILLS OUTCOMES: ***focus*** on scientific inquiry (embed throughout unit)	
Initiating and Planning: Ask questions about the relationships between & among observable variables, and plan investigations to address 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)*
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) [**Prerequisite Skill:** Grade 7 Mathematics, Statistics and Probability, Specific Outcome 4; Related Skills: Grade 9 Mathematics, Statistics and Probability, Specific Outcomes 2, 3] • 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 element?" 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)

SCIENCE GRADE 9

Matter and Chemical Change

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
ATTITUDE OUTCOMES (embed throughout unit)	
Interest in Science: encouraged to develop enthusiasm and continuing interest in the study of 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.	• Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds *(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: develop attitudes that support active inquiry, problem solving and decision making	• 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: develop attitudes that support collaborative activity.	• 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: develop responsibility in the application of science and technology in relation to society and the natural environment.	• 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: demonstrate a concern for safety in science and technology contexts.	• 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)*
Environmental Chemistry **Essential Questions:** What substances do we find in local and global environments? What role do they play, and how do changes in their concentration and distribution affect living things?	
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) • Describe, in general terms, the forms of organic matter synthesized by plants and animals, including carbohydrates, proteins and lipids • 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)

Environmental Chemistry

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	• 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) • 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)
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 • 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) • Identify chemical factors in an environment that might affect the health and distribution of living things in that environment (e.g., available oxygen, pH, dissolved nutrients in soil) • Apply and interpret measures of chemical concentration in parts per million, billion or trillion [**Prerequisite Skills**: Grade 8 Mathematics, Number, Specific Outcomes 14, 15] • 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) • 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) • Describe effects of acids and bases on living things (e.g., acid rain in lakes, antacids for upset stomachs, pH in shampoos and conditioners)
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) • Describe mechanisms for biodegradation, and interpret information on the biodegradability of different materials • Comprehend information on the biological impacts of hazardous chemicals on local and global environments, by: o Interpreting evidence for environmental changes in the vicinity of a substance release o 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.] o 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

Environmental Chemistry

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	• 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) • 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)
SKILLS OUTCOMES: ***focus*** on use of research and inquiry skills to inform the decision-making process **(embed throughout unit)**	
Initiating and Planning: Ask questions about the relationships between & among observable variables, and plan investigations to address 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)* • 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)* **[Related Skills:** Grade 9 Mathematics, Statistics and Probability, Specific Outcomes 4, 5] • 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)* **[Related Skills:** Grade 9 Mathematics, Statistics and Probability, Specific Outcomes 2, 3] • Identify new questions and problems that arise from what was learned

Environmental Chemistry

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
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)*
ATTITUDE OUTCOMES (embed throughout unit)	
Interest in Science: encouraged to develop enthusiasm and continuing interest in the study of 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.	• 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: develop attitudes that support active inquiry, problem solving and decision making	• 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: develop attitudes that support collaborative activity.	• 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: develop responsibility in the application of science and technology in relation to society and the natural environment.	• 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)*
Safety: demonstrate a concern for safety in science and technology contexts.	• 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)*

Electrical Principles and Technologies

Essential Questions:

How do we obtain and use electrical energy?
What scientific principles are involved?
What approaches can we use in selecting, developing and using energy-consuming devices that are efficient and effective in their energy use?

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 • Investigate and describe evidence of energy transfer and transformation *(e.g., mechanical energy transformed into electrical energy, electrical energy transferred*

Electrical Principles and Technologies

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	*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)*
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 leads and salt solution)* o Apply Ohm's law to calculate resistance, voltage and current in simple circuits **[Prerequisite Skill**: Grade 8 Mathematics, Patterns and Relations, Specific Outcome 5] • 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)*

Electrical Principles and Technologies

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
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 • Apply appropriate units, measures and devices in determining and describing quantities of energy transformed by an electrical device, by: o 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) o 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)] **[Prerequisite Skill:** Grade 8 Mathematics, Patterns and Relations, Specific Outcome 5] • Apply 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)* • 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)* **[Prerequisite Skills:** Grade 7 Mathematics, Number, Specific Outcome 18; Grade 8 Mathematics, Number, Specific Outcome 12] • 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)*
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)* • 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
SKILLS OUTCOMES *Focus* on problem-solving **(embed throughout unit)**	
Initiating and Planning: Ask questions about the relationships between & among observable variables, and plan investigations to address 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?")*

Electrical Principles and Technologies

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	• 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)*
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)*
ATTITUDE OUTCOMES (embed throughout unit)	
Interest in Science: encouraged to develop enthusiasm and continuing interest in the study of 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.	• *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: develop attitudes that support active inquiry, problem solving and decision making	• Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues *(e.g., strive to assess a problem or situation accurately, by*

Electrical Principles and Technologies

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	*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: develop attitudes that support collaborative activity.	• 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: develop responsibility in the application of science and technology in relation to society and the natural environment.	• 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: demonstrate a concern for safety in science and technology contexts.	• 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)*

Space Exploration

Essential Questions:

How have humans attained a presence in space?

What technologies have been developed and on what scientific ideas are they based? How has the development of these technologies contributed to the exploration, use and understanding of space and to benefits on Earth?

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)* • 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: o 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)* o Describing in general terms how parallax and the doppler effect are used to estimate distances of objects in space and to determine their motion o 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*

Space Exploration

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	*ascension and declination is not required.]* **[Prerequisite Skills:** Grade 7 Mathematics, Shape and Space, Specific Outcomes 11, 13; Related Skills: Grade 9 Mathematics, Shape and Space, Specific Outcomes 13, 14] • 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)
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)*
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.]
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) • 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)
SKILLS OUTCOMES *Focus* on problem-solving **(embed throughout unit)**	
Initiating and Planning: Ask questions about the relationships between & among observable variables, and plan investigations to address questions	• Identify practical problems (e.g., identify problems that must be addressed in developing a life supporting 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)

Space Exploration

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
(Continued)	• 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)
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)*
ATTITUDE OUTCOMES (embed throughout unit)	
Interest in Science: encouraged to develop enthusiasm and continuing interest in the study of 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)*
Mutual Respect: appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds.	• *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: develop attitudes that support active inquiry, problem solving and decision making	• 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)*

Space Exploration

Outcomes	Achievement indicators – measurable outcomes
It is expected that students will:	*The following set of indicators is used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Collaboration: develop attitudes that support collaborative activity.	• 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: develop responsibility in the application of science and technology in relation to society and the natural environment.	• 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: demonstrate a concern for safety in science and technology contexts.	• 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)*