Science 6-8

CURRICULUM COMPANION DOCUMENT

Description and Rationale

This companion document for New Brunswick Middle Block Science (grades 6-8) is designed to help any educator implement the program at their school(s) regardless of their years of teaching, training, or experience in this learning area.

Educators can use this document to support engaging instructional practices, hands-on investigations, and group activities. To develop scientific literacy, diverse learning experiences provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand interrelationships among science, technology, engineering, mathematics, society, and environment. Inquiry learning, investigation, sensemaking, communication, responsible, and sustainable application skills are highlighted within this document through instructional practices.

This companion document is aligned to the design of Learning Areas, which includes Strands, Big Ideas and Skill Descriptors to support achievement of learning. For reporting on achievement of learning in New Brunswick, educators use a 4-point scale to communicate achievement for each curricular strand. Assessment of Skill Descriptors is informed by evidence of learning outlined in the Achievement Indicators for each grade level and Learning Area. Skill Descriptors are end-of-year expectations. More information including report card guidelines can be found on the Assessing, Evaluating, Reporting Grades K-12 SharePoint site.

To use the document effectively, educators should become familiar with the New Brunswick Curriculum Framework and the knowledge and skills learners demonstrate through Achievement Indicators. This companion document contains instructional strategies, labs, inquiry opportunities, potential assessments, and background information to support prescribed curriculum delivery. Science concept vocabulary is found in the glossary. The Core Concepts and Essential Questions sections are individualized for each grade.

As Cummins and Early (2015) point out: “language is infused in all curricular content” (p.11). This means that all educators are teachers of language. Instruction for learners learning the language of instruction at the same time as content must include the intentional development of academic language. High yield strategies for supporting learners with the language of science are included throughout this document.

Effective Teaching Strategies

PROCESSES OF SCIENTIFIC LITERACY

Scientific inquiry: involves specific science skills including posing questions and developing explanations for phenomena. Questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analyzing data, and interpreting data are fundamental science skills within scientific inquiry.

Scientific problem-solving: involves seeking solutions to human problems. Proposing, creating, and testing prototypes, products, and techniques to determine the best solution to given problems is fundamental to scientific problem-solving.

Scientific decision-making: involves determining what we, as citizens, should scientifically do in specific contexts or in response to given situations. Decision-making is generally important but also provides relevant contexts for engaging in scientific inquiry and/or scientific problem solving.

INQUIRY-BASED LEARNING

Inquiry-based learning is fundamental to New Brunswick education and science skill development. Evidence about instructional approaches that consistently have a positive impact reveals learners achieve the most when educators promote Play and Inquiry-Based Learning pedagogy. Inquiry-based learning involves learner-led questioning and investigation of interests and information, an iterative process of investigation, reflection, and communication.

When designing inquiry-based learning opportunities, focus is on learners' curiosity and wonder and the questions that emerge from exploration and investigations. Designing learning starts with the gradual release of responsibility during the inquiry process; this develops learner agency. Inquiry starts with an essential question that: requires critical thinking skills to answer; sparks debate; starts with Should…? Why…? What if…? How might we…? I wonder …?

The Smarter Science Framework (2011) and National Research Council's A Framework for K-12 Science Education (2012) both add context and detail for scientific inquiry, assessment, and evaluation.

The Smarter Science Framework is an open-source framework for teaching and learning K-12 science and developing the skills of inquiry, creativity, and innovation in a meaningful and engaging manner. The Smarter Science Framework includes 35 inquiry process skills that enable learners to plan and implement investigations.

A Framework for K-12 Science Education outlines a broad set of Grades K-12 science and engineering expectations. Science and engineering education should be built through crosscutting concepts that unify the study of science through common application across science and engineering; scientific and engineering practices; disciplinary core ideas in physical sciences, life sciences, and Earth and space sciences. Learner goals include possessing sufficient knowledge of science and engineering to engage in public discussions on science-related issues, be careful consumers of scientific and technical information, and enter careers of choice or personal interest.

Below are science inquiry-based strategies for developing New Brunswick science curriculum Big Ideas, particularly: **Investigation**, **Sensemaking**, and **Communication**. The big ideas have been aligned below with categories in the Smarter Science Framework: Initiate and Plan; Perform and Record; Analyze and Interpret; Communication:

New Brunswick Science Big Idea: **Investigation**

- Initiate and Plan: encourage learners to identify a problem or need through curious observation; define testable questions, research, and consider possible answers and solutions; revisit observations and predictions to improve testable questions.

  Learners form hypotheses from observations, questions, and research. Develop observation and questioning skills by providing science prompts (e.g., Phenomena for Next Generation Science Standards).
- Perform and Record: encourage learners to develop and safely carry out investigations; observe, collect, and record results.

  Learners develop observation and recording skills by maintaining scientific journals or notebooks for observations, thoughts, and reflections. Provide opportunities for learners to experiment and test hypotheses and answer questions. Consider knowledge and skills related to variables, controls, and the scientific process. Encourage learners to use tools and/or technology to amplify their senses and accurately record data.

New Brunswick Science Big Idea: **Sensemaking**

- Analyze and Interpret: encourage learners to review results carefully by examining data and identifying patterns; decide what results mean; evaluate and refine solutions.

  Once learners carry out investigations, the focus shifts to analysis and evaluation of data, determining meaning, or sensemaking.

New Brunswick Science Big Idea: **Communication**

- Communicate: encourage learners to explain procedures and results through various modes, including writing, speaking, visual, or electronic forms; reflect on the scientific process and check with peers.

  Learners develop communication skills through opportunities to collaborate and share science concepts and ideas within the classroom and community. Learners make sense of new information using languages that are contextually meaningful as steps to using scientific language. Learners formally and informally communicate findings and understandings for a range of purposes and audiences.

TRANSDISCIPLINARY LEARNING

In the *OECD Science, Technology, and Industry Policy Paper,* "Addressing Societal Challenges Using Transdisciplinary Research," the Organisation for Economic Co-operation and Development (OECD) states Transdisciplinary Research can help address complex societal challenges. OECD defines Transdisciplinary research (TDR) as the integration of knowledge from different science disciplines and non-academic stakeholder communities. Therefore, Transdisciplinary Learning is critical to achieving sustainability goals in the New Brunswick Curriculum Framework, the New Brunswick Climate Education Framework, and New Brunswick Wabanaki Learning Framework.

Transdisciplinary Learning can happen in formal, informal, and nonformal settings. The practice takes contextual problems as starting points, integrates different knowledges relevant to addressing the problems, and aims to contribute to solving problems through responsible and sustainable actions between and across disciplines.

In Middle Block Science, Transdisciplinary Learning looks like asking questions that lead to scientific inquiry, suggesting materials to investigate questions, and observing and collecting data; looks like defining practical design problems, reflecting on specified criteria for success, identifying models or prototypes that can be improved in applied contexts.

CROSS-CURRICULAR CONNECTIONS

With a focus on inquiry skills and scientific exploration, there are numerous opportunities to authentically connect with other subject areas. Below you will find some exemplars of skill descriptors from other subject areas and where they potentially connect to Middle Block Science curriculum.

Subject	Skill Descriptor	Science Skill Descriptor
English Language Arts	Grade 6: Summarize and present content to communicate facts, ideas, and opinions.	Communicate procedure, result, and conclusion using a variety of media and working collaboratively.
Physical Education	Grade 6: Apply social-emotional skills used in learning and performing physical activities, alone and with others.	Apply scientific and technological knowledge and an understanding of sustainable practices responsibly with respect to natural and technical sensory systems.
Mathematics	Grade 6: Justify elements and compare graphs to solve problems.	Analyze and interpret qualitative and quantitative data to construct explanations and conclusions.
Mathematics	Grade 7: Calculate measures of central tendency to solve problems.	Analyze and interpret qualitative and quantitative data to construct explanations and conclusions.
Social Studies	Grade 7: Analyze the effects of the distribution of wealth around the world.	Analyze and interpret qualitative and quantitative data to construct explanations and conclusions.
Mathematics	Grade 8: Compare and critique graphs and the presentation of data.	Communicate procedure, result, and conclusion using a variety of media and working collaboratively.

SCIENTIST NOTEBOOKS

Scientific journaling can be completed by educators and learners together with self-assessment and goal setting. Educators can model examples of known scientists' notebooks to demonstrate learning and scientific process. Learners demonstrate achievement of learning through scientific journal sketches,

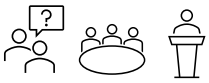
describing observations and ideas, asking questions, generating hypotheses, outlining next steps, and verbalizing learning goals (Gregory, Cameron, Davis, 2011). Science journaling allows expressive and reflective writing that helps learners record, organize, and understand information from different sources. The process can include creating webs, maps, charts, tables, graphs, drawing, and diagrams to represent data and results.

SCIENCE SKILLS

Science education focuses on the enactment of science skills in different learning contexts. Science skills are also transferrable between science contexts. Science skills enacted in Grades 6-8 include:

- Planning and conducting investigations
- Asking questions
- Considering and determining variables
- Explaining data
- Defining problems and criteria
- Responding to the ideas of others
- Brainstorming
- Collecting, recording, differentiating between, representing, analyzing data
- Measuring
- Describing and discussing observations
- Interpolating and extrapolating
- Classifying patterns, sorting rules, trends
- Constructing explanations and conclusions
- Creating diagrams, models, tables, graphs, drawings
- Interpreting maps, graphs, statistics and probability
- Evaluating precision/validity/reliability
- Applying measures of central tendency
- Identifying new questions
- Applying science learning to new situations
- Communicating procedures, results, and conclusions
- Supporting or refuting hypotheses
- Communicating problem-solving
- Applying science, mathematics, and technology language
- Working collaboratively
- Discussing Wabanaki understandings and identity
- Outlining relationships
- Investigating impacts
- Iterating designs
- Applying systems thinking
- Demonstrating respect and responsibility for living things
- Identifying parts or components
- Identifying behaviours
- Exploring careers
- Using equipment, tool, and materials safely
- Practising safety rules
- Raising awareness
- Reflecting on applications, decisions, and possible actions

CULTURALLY AND LINGUISTICALLY INCLUSIVE INSTRUCTION

Support Comprehensible Input	Support Comprehensible Output	Support Real Life connections
Clarify instructions and other texts by simplifying, chunking, and adding visuals. E.g., **Before**: Discuss observations and ideas from scientific inquiry, peers, educators, and/or guests. **After**: Discuss  Observations  From many sources 	Incorporate structured conversations (provide a prompt and a sentence frame for responding. Model first, then have learners exchange responses orally in small groups). **Prompt:** Identify new questions because of new information. **Sentence Frame:** Because of _____, my next question is _____. **Model:** Because I now know the temperature of the object, my next question is how warm is sunlight?	Use visual, graphic, and sensory supports (Hyunh and Skelton, 2023). **Visual Supports**: Use photos of Earth locations at different times to support understanding of cycles. **Graphic Supports**: Use tables and graphs to illustrate distances and force related human presence in the solar system. **Sensory Supports**: If possible, physically touch and explore the operation of different wayfinding devices and technologies.

Core Concepts

The context for each Middle Block Science grade are listed below. An overview of each concept for each specific science grade are listed sequentially below. Possible pathways to frame inquiry and apply science skills are found within the Science Storylining subsection.

Middle Block Science:

- Science 6: Wayfinding and Making Sense of Your World
- Science 7: Earth Surface Processes
- Science 8: Beyond Earth: Human Presence in the Solar System

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

The United Nations Sustainable Development Goals secure sustainable, peaceful, prosperous, and equitable life on Earth for everyone now and in the future. To create a more sustainable world, and engage with sustainability issues, learners must become sustainability change-makers. Education, therefore, is vital for the achievement of sustainable development. By intentionally connecting classroom learning to these goals, educators create relevant context for learners to become global citizens and critical thinkers.

SCIENCE 6: WAYFINDING AND MAKING SENSE OF YOUR WORLD

The context of Science 6: Wayfinding and Making Sense of Your World includes the United Nations Sustainable Development Goals:

3 – Good Health and Well-Being: Ensure healthy lives and promote well-being for all at all ages.

10 – Reduced Inequalities: Reduce inequality within and among countries.

14 – Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.

15 – Life on Land: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

The concepts of Science 6: Wayfinding and Making Sense of Your World include:

- **Behaviour and properties of light, sound, and olfactory receptors**

  In Grade 6, behaviours and properties of light include Electromagnetic Spectrum (EMS), sources of visible light, dispersion, absorption, and transmission of light, law of reflection, law of refraction, shape, location, and size of shadow formation; behaviours and properties of sound include propagation through different mediums; behaviours and properties of olfactory receptors include biochemical and biophysical receptors.

  Light travels in a straight line (rectilinear propagation) and travels away from the source in all directions. The dispersal of light can only be seen if light has something from which to reflect, for example when light is reflected into the eye. The learning context introduces terms such as opaque, transparent, and translucent. Some materials are opaque, transparent, or translucent; some materials will reflect, refract, or disperse light. The learning context may include questions such as "Where is the light coming from so objects are visible?"

  Exploration of the properties of lenses may include convex, concave, and other variations of lenses. Images can be magnified or made smaller, depending on the type of lens used. The shape of the lens and the characteristics (relative size, orientation, relative distance) determine images.

  Sound can be sensed, measured, and controlled. Sound is caused by vibrations. The learning context uses terms such as pitch and loudness to describe sound. Pitch is how high or low a vibration of sound appears to be, how fast something vibrates is related to pitch. The learning context may include questions such as, "Do all vibrations sound the same?" "How does tightening strings impact pitch?" "How does faster or slower vibrations impact pitch?" "Hoes does strength of striking forces impact loudness?" "Where are noise levels the highest?" "Which materials are best for absorbing sound?"

  In Grade 6, learners use information about light, sound, and smell, their behaviours and properties, and how humans detect and process light, sound, and smell to better understand the perceptions of their world.

- **Interactions among sense organs, nerves, and the brain enabling organisms to predict, analyze, and respond to changes in their environment**

  Organisms modify behavior or responses based on biological inputs and interactions among sense organs. They produce response actions from collected information that is processed. Stimuli produce functional reactions. **In Grade 6**, interactions among light sensing organs include detection and response to visible light, light sensing organs of different kingdoms, models of human eye structures and functions. **In Grade 6**, interactions among auditory sense organs include detection and response, how different organisms process sound, model of human ear structures and functions. **In Grade 6**, interactions among tactile, gustatory, and olfactory sense organs include conditions and diseases affecting organs, preventative actions, and treatments; interactions include between vestibular and proprioception organs.

- **Information processing**

  The nervous system coordinates actions and sensory information, detecting environmental changes, then working with other systems to respond. **In Grade 6**, learners discover the nervous system serves the processing of information from sense organs. Coordinating networks organize sense organs, receptors, and information processing which includes the brain, spinal cord, and nerve network.

- **Wayfinding technologies**

  Wayfinding includes ways organisms orient themselves in physical space and navigate environments. Wayfinding technologies are devices or systems that help or enhance navigation of environments. **In Grade 6**, both natural and human-made wayfinding devices are explored including telescopes, periscopes, eyes, ears, cameras, and remote sensing. The learning context may include questions such as, "How does general development of technology impact wayfinding devices and technologies?" "Why do humans depend on enhanced human-made wayfinding technologies?" "What are uses of human-made wayfinding technologies?"

- **Corrective technologies**

  Corrective technologies directly enhance, correct for, or compensate for the change of the function of organic sense organs. **In Grade 6**, corrective technologies that modify stimuli include eyeglasses and hearing aids.

- **Adaptive technologies**

  Adaptive technologies indirectly enhance, accommodate for, or support the functionality of organic sense organs. **In Grade 6**, adaptive technologies include Braille, immersive readers, and seeing-eye dogs.

Scientific literacy contributes to learning to live sustainably by supporting people in solving complex interconnected problems related to socio-environmental systems and sustainability in communities. Contributions to scientific literacy include evidence-based argumentation, ethics in science, and understanding and application of science content knowledge. It also includes knowledge within other learning areas.

- **Correct use of equipment and tools**

  Correct and safe use of equipment and tools relates to sustainability through the preservation of resources and learning to use specific tools to collect appropriate data to solve complex problems. Awareness and accountability of safety increases awareness of actions and of impact. **In Grade 6**, correct use of equipment and tools include magnifying lenses, meter sticks, microscopes, LED flashlights, laser pointers, mirrors, prisms, and ultraviolet beads.

- **Conducting field work and investigations safely**

  Field work is inherently risky. Conducting field work and investigations is as important to sustainability as conducting standardized procedures and ethical teaming. **In Grade 6**, conducting field work and investigations safely considers learners' transition to more independent investigations with less educator direction, larger physical boundaries, and more open-ended exploration.

- **Safety and prevention practice**

  Standardized procedures for identifying risk and protective factors relate to sustainability through science and laboratory design, and balances health and safety of humans with the required work in science or laboratory contexts. For example, some science practices can be safely completed with reusable materials. **In Grade 6**, safety and prevention practice includes wafting (vapor and fume safety), eyewear, protective earwear, gloves, ultraviolet clothing, and sunscreen.

  For example, decibels are a unit of measure for the level of intensity of sound. Most of the time, humans ignore a large amount of background noise. Some human devices produce loud noises that can damage hearing, related to intensity of sound and length of exposure to sound. The varying ability of humans and other animals to detect sound leads to the necessity of protecting the sense of hearing.

- **Sensory processing issues**

  Learning strategies that accommodate for sensory processing issues balance sensory needs with science and laboratory context safety; they do not compromise safety. Sensory processing issues may be supported with consistent daily routines, advance warnings of changes to routine, clear starting and ending times for tasks, posting visual schedules, directions, to-do lists, and classroom expectations. For example, in some cases earplugs or noise-muffling headphones accommodate for auditory processing issues but may conflict with science or laboratory context safety.

- **Health and well-being of self**

  In Grade 6, learners leverage science knowledge and understanding to inform health and well-being of self including sensory organs: eye, ear, olfactory system organs. In Middle Block Personal Wellness, learners examine their own personal health and how their choices and habits impact personal wellness, including helpful and harmful choices and personal safety. In Middle Block Physical Education, learners set goals and make positive choices about their own physical wellness and well-being and seek out increased opportunities for healthy decision-making including social-emotional skills.

- **Empathy for those with sensory impairments, sensory processing issues, sensory seeking, sensory avoiding**

  The Relationships and Connections Shared Tenet describes the belief as collaborating, respecting, and supporting each other and sounds like kind and empathic individuals who want the best for others. The Well-Being Shared Tenet feels like a safe and welcoming space for all learners to be their true selves. Inclusion and Equity sounds like each learner's voice being heard, respected, and celebrated by their collaborative education team in the common learning environment and school community. Therefore, empathy for those with sensory impairments can be enacted through Dispositions: being present by practicing curiosity and reflection; having courage to strive, make mistakes, offer forgiveness, and to think differently; being grateful by practicing respect, patience, and generosity.

- **Life and career pathways**

  The idea of career pathway planning is supported through evidence-based practices such as experiential learning, labour market information learning, social-emotional learning, global competency learning, and financial wellness learning. The Career Connected Learning K-12 framework complements and supports existing career education strategies. **In Grade 6**, life and career pathways include scientific literate citizens, eye surgeons, Ears, Nose, Throat (ENT) specialists, hearing health professionals, audiologists, hearing instrument technicians, optometrists, ophthalmologists, etc.

- **Science and the UN Sustainable Development Goals 3, 10, 14, 15**

  In Grade 6, inquiry and science investigations apply technology and are framed by the United Nations Sustainable Development Goals 3 – Good Health and Well-Being, 10 – Reduced Inequalities, 14 – Life Below Water and 15 – Life on Land. Global targets framing Science 6: Wayfinding and Making Sense of Your World include: supporting the research and development of vaccines; empowering and promoting social, economic, and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion, economic, or other status; increasing scientific knowledge, developing research capacity, and transferring marine technology; mobilizing and increasing financial resources from all sources to sustainably use biodiversity and ecosystems in applications of science and technology.

- **Design challenge**

  The **Grade 6** design challenge: apply technology to build accessibility devices addressing sensory impairments and/or limitations. An example solution includes designing or building sensory rooms which are designed to develop one's senses or used in types of therapy.

- **Ecological systems**

  In Grade 6, application of technology relating to ecological systems includes economic and environmental challenges of making stuff, what humans make, how humans make stuff, how the making process fits into larger systems, and life cycles of products.

SCIENCE 7: EARTH SURFACE PROCESSES

The context of Science 7: Earth Surface Processes includes the United Nations Sustainable Development Goals

11 – Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable.

13 – Climate Action: Take urgent action to combat climate change and its impacts.

14 – Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.

15 – Life on Land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

The concepts of Science 7: Earth Surface Processes include:

- **Particle model of matter**

  Particle models of matter are scientifically important because they allow humans to reasonably explain behaviours of matter, describe particles as always in motion, explain properties of matter, and predict changes. **In Grade 7**, particle model of matter includes states of matter: solids, liquids, gas, and plasma.

- **Quantitative analysis of physical properties**

  Quantitative research focuses on collection and analysis of numerical data used to find patterns and averages, make predictions, test causal relationships, and generalize results. **In Grade 7**, quantitative analysis of physical properties includes temperature, mass, volume, and density.

- **Energy transfer and conservation**

  The amount of energy in systems, including transfer and conservation of energy, can be scientifically measured. and modelled. **In Grade 7**, energy transfer and conservation include the first law of thermodynamics, heat compared to temperature, convection, conduction, and radiation energy transfer, and the role of energy in transforming matter.

- **Heating curve**

  Heating curves are graphs that show relationship between temperature and amount of heat added to substances, showing changes in temperature as substances absorb more heat and plateaus where temperature remains constant during phase transitions. **In Grade 7**, heating curve includes temperature, heat compared to temperature, and boiling, melting, and freezing points of water.

- **Weather systems and climate**

  Understanding of the nature of science is built through inquiry supported by core ideas and concepts connected to physical sciences, Earth, and space sciences. Weather is patterns of seasonal change, it is the state of the atmosphere including air pressure, temperature, and moisture differences. Climate is an area's typical weather condition over time. It is the mean and variability of

meteorological variables including temperature, humidity, atmospheric pressure, wind, and precipitation. **In Grade 7**, learners differentiate between weather systems and climate, including extreme weather events as part of existing systems and/or as part of climate change.

- **Earth systems**

  Earth systems considers interactions between Earth's sub-system cycles, processes, spheres, and humans. **In Grade 7**, Earth systems include biosphere, atmosphere, hydrosphere, and geosphere.

- **Definitions**

  In Grade 7, definitions include for weather, climate, global warming. Weather: description of the state of the atmosphere. Climate: the averaging of atmospheric conditions, long-term weather patterns in regions. Global warming: the ongoing increase in average global temperature primarily caused by humans burning fossil fuels.

- **Cycles**

  Weather cycles are recurring changes in atmospheric conditions caused by natural factors. Climate cycles are collective effects of changes in Earth's movements on climate over long periods of time. **In Grade 7**, cycles include seasonal day/night and sunlight differences, fresh and saltwater cycles, atmospheric flow patterns, and gravity.

- **Water in the atmosphere**

  Earth's atmosphere is the layer of gases retained by gravity including water vapor. **In Grade 7**, water in the atmosphere includes complex patterns of changes: movement of water by winds, landforms, and ocean temperatures and currents; solidification, evaporation, transpiration, condensation, and sublimation phases of water; rain, snow, sleet, hail, etc. precipitation forms.

- **Quantitative analysis**

  Quantitative analysis of weather systems and climate trends can predict changing weather patterns and climate parameters and changing climate conditions and effects. **In Grade 7**, quantitative analysis of weather systems and climate includes insolation, albedo, air temperature, wind speed and direction, humidity, barometric pressure, and amount of precipitation.

- **Weather patterns**

  Weather patterns describe local weather resulting from large global patterns. Weather is also influenced by less-predictable global phenomena involving irregular patterns including El Niño–Southern Oscillation (ENSO). **In Grade 7**, weather patterns include trends and relationships between barometric pressure, temperature, precipitation patterns, and weather systems.

- **Meteorology**

  Meteorology is atmospheric science focusing on weather forecasting. **In Grade 7**, meteorology includes digital and analog weather instruments; satellite imagery and other forms of remote sensing; monitoring, reporting, and predicting weather through traditional knowledge systems and Ways of Knowing; weather forecasting accuracy and reliability. The learning context may include

questions such as, “How are models used by scientists to understand natural climate phenomena?” ”Why is it important for the public and society to understand weather patterns?”

Scientific literacy contributes to learning to live sustainably by supporting people in solving complex interconnected problems related to socio-environmental systems and sustainability in communities. Contributions to scientific literacy include evidence-based argumentation, ethics in science, and understanding and application of science content knowledge. It also includes knowledge within other learning areas.

- **Correct use of equipment and tools**

  Correct and safe use of equipment and tools relates to sustainability through the preservation of resources and learning to use specific tools to collect appropriate data to solve complex problems. Awareness and accountability of safety increases awareness of actions and of impact. **In Grade 7**, correct use of equipment and tools include safety glasses, magnifying lenses, plastic eye droppers, microscopes, data gathering sensors, water testing kits, and density kits.

- **Conducting field work and investigations safely**

  Field work is inherently risky. Conducting field work and investigations safety relates to sustainability through standardized procedures and ethical teaming. Modeling, monitoring of, and safe collection of, data by scientists relating to extreme weather events are completed by governments or weather organizations. Government of Canada Weather Information provides weather alerts, data and modelling, and analysis. **In Grade 7**, conducting field work and investigations safely considers learners’ transition to more independent investigations with less educator direction, larger physical boundaries, and more open-ended exploration.

- **Emergency preparedness, severe weather**

  Emergency preparedness are the actions and measures taken before, during, and after an emergency to reduce loss of life and property damage due to hazards, including planning, organizing, training, equipping, exercising, evaluating, and taking corrective actions for significant seasonal or unseasonal weather systems or conditions. Emergency plans describe what to do in emergencies and identify community members who may need extra help during emergencies. Emergency kits are collections of tools and supplies that provide extra help, and support health and survival in emergencies. Emergency preparedness includes severe weather procedures, and steps undertaken to keep humans and animals safe during extreme weather systems, including monitoring news, alerts, shutdown procedures, evacuation routes, etc. **In Grade 7**, severe weather includes blizzards, flooding, drought, and forest fires.

- **Climate science basics, climate resilience**

  Climate is an area’s typical weather condition over time. Climate science is the scientific study of Earth's climate, weather conditions averaged over periods of time. Climate resilience is the ability to recover from, or mitigate vulnerability to, climate-related shocks. It describes social, economic, and ecosystem capacities. **In Grade 7**, climate science basics include greenhouse gas effects, carbon cycle, and sea level rise and severe weather physical impacts. **In Grade 7**, climate resilience includes adaptation, mitigation, and prevention strategies.

- **Global climate systems, local and global impacts**

  In Grade 7, global climate systems include definitions for global warming, greenhouse effect, and climate change. **In Grade 7**, local and global impacts include economic, societal, environmental concepts and connection to human lives and threats to biodiversity. For example, sustainable urban design explores how cities are created mitigating environmental impacts and withstanding extreme weather events, ensuring community preparedness for climate change.

- **Technology for good, mitigation and adaptation simulations**

  Technology for good considers sustainability and practices such as building trust, respecting data, working with transparency, providing choice, reskilling the future, inclusion, and participation in collaborative government. Mitigation treats root causes of climate change. Adaptation creates solutions for climate change. **In Grade 7**, technology for good includes climate modelling, specifically mitigation and adaptation simulations.

- **Impact analysis across spatial and temporal scales, impact of geographic locale on weather, impact of weather on land and infrastructure**

  Impact analysis is the study of the effects of change. Spatial scale is the size of space, the physical extent, of events or processes. Temporal scale is length or duration of events or processes, points in time or time span for which system phenomena are considered. **In Grade 7**, impact analysis across spatial and temporal scales include: local, regional, national, and global levels; coastal, land-locked, and lake-effect geographic locale impacts on weather; coast erosion, flooding, electricity outage, and weather impacts on land and infrastructure.

- **Life and career pathways**

  The idea of career pathway planning is supported through evidence-based practices such as experiential learning, labour market information learning, social-emotional learning, global competency learning, and financial wellness learning. The Career Connected Learning K-12 framework complements and supports existing career education strategies. **In Grade 7**, life and career pathways include climate literate citizens, meteorologists, climatologists, climate scientists, areas involving climate adaptation and mitigation, etc.

- **Science and the UN Sustainable Development Goals 11, 13, 14, 15**

  In Grade 7, inquiry and science investigations apply technology and are framed by the United Nations Sustainable Development Goals 11 – Sustainable Cities and Communities, 13 – Climate Action, 14 – Life Below Water and 15 – Life on Land.

  Global targets framing Science 7: Earth Surface Processes include: increasing number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change and resilience to disasters; strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries; minimizing and addressing impacts of ocean acidification; combatting desertification, restoring degraded land and soil, and striving to achieve a land degradation-neutral world.

- **Provincial weather sensor array**

  Sensor arrays are groups of sensors deployed in geometric patterns or covering specific areas. Arrays of sensors estimate more parameters, collect more data, and improve estimation and performance compared to individual sensors. **In Grade 7**, provincial weather sensor array includes collaborating to create province-wide weather monitoring stations.

SCIENCE 8: BEYOND EARTH: HUMAN PRESENCE IN THE SOLAR SYSTEM

The context of Science 8: Beyond Earth: Human Presence in the Solar System includes the United Nations Sustainable Development Goals 3 – Good Health and Well-Being: Ensure healthy lives and promote well-being for all at all ages,

9 – Industry, Innovation, and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation,

13 – Climate Action: Take urgent action to combat climate change and its impacts,

17 – Partnerships for the Goals: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

The concepts of Science 8: Beyond Earth: Human Presence in the Solar System include:

- **Qualitative descriptions of motion**

  Motion is defined as objects changing position with respect to reference points over time, described by displacement, distance, velocity, acceleration, speed, and frame of reference to observers. **In Grade 8**, qualitative descriptions of motion include direction of movement, time taken to travel set distances, acceleration, rotation, and revolution.

- **Force as a physical property**

  Forces are strength or energy as attributes of physical actions or movements. Forces move objects or hold objects in place. **In Grade 8**, force as a physical property includes push and pull, and area and pressure forces. Push forces move objects away from reference points, while pull forces move objects towards reference points. Area forces are distributed forces with points of application across surfaces. Pressure forces are applied perpendicular to the surface of objects per unit area.

- **Forces and interactions**

  In Grade 8, forces and interactions include contact, gravitational and muscular forces, and interactions. Contact forces describe objects contacting each other. Gravitational forces describe attraction of objects that have mass. Muscular forces describe force applied to use body parts.

- **Laws of Motion definitions**

  The laws of motion describe relationship between motion of objects and forces acting on them. Summarizing the laws of motion, bodies remain at rest or in motion at constant speed in a straight line unless acted upon by forces. Net force on bodies equals acceleration multiplied by mass,

describing the rate momentum changes over time. Momentum depends upon the amount of matter contained in bodies, the speed which bodies are moving, and direction of movement. In modern scientific notation, the momentum of bodies is the product of mass and velocity. If two bodies exert forces on each other, forces have the same magnitude but opposite directions. The first term is the total force acting upon the first body, and the second term is the total force acting upon the second body. If the two bodies are isolated from outside influences, the only force acting upon the first body is the force from the second, and vice versa. The two forces have equal magnitude but opposite direction, they cancel when added. **In Grade 8**, laws of motion definitions include hypothesis, theory, and law.

- **Law of Gravity**

  The law of gravity describes every particle attracts every other particle with force proportional to the product of masses, and inversely proportional to the square of the distance between centers. Separated objects attract as if all their mass were concentrated at their centers. **In Grade 8**, law of gravity includes descriptions of forces and the acceleration due to gravity (9.8 m/s^2).

- **Newton's Laws**

  Isaac Newton was a fifteenth century scientist who hypothesized the laws of motion and law of gravity. **In Grade 8**, Newton's laws include inertia, net force, balanced, and unbalanced forces; effects of force and mass on acceleration; actions-reactions and forces in pairs.

- **Solar system, movement of celestial body, types of celestial objects**

  The Solar System is the gravitationally bound system of the sun including Earth and other objects. Celestial describes bodies and objects positioned in or relating to the sky and outer space. **In Grade 8**, Solar System, movement of celestial body, and types of celestial objects include Earth's place in the universe, rotation and revolution movements of celestial bodies and near-Earth objects (NEOs), planets, moons, stars, and other celestial objects.

- **Space travel**

  Space travel includes space flight and applying astronautics to fly objects into or through outer space, with or without humans on board. **In Grade 8**, space travel includes rockets, propulsion, fuel, navigation and steering, and atmospheric drag aeronautics; design, construction, modular parts, form, and function of spaceships; hydraulics, gravity, atmospheric drag, and friction propulsion concepts.

- **Living and working in space**

  In addition to space travel and survival, humans have evolved within the gravitational force of Earth, therefore ongoing time in microgravity environments represent specific human challenges. Human research in space and microgravity environments has facilitated non-space discoveries, innovations and technology including disease research, development of water purification systems, drug development, growing food, and identifying unknown microbes. **In Grade 8**, living and working in space includes hazards, weightlessness, and effects on human systems. The learning context may

include questions such as, “How does the force of gravity on Earth compare with the force of gravity in outer space?”

- **Robotics**

  Space robotics is the use of robotic technology in space exploration, operations, maintenance, repair, and data collection. Robotics are used to aid, augment and substitute tasks for astronauts. **In Grade 8**, space robotics includes Canadarm1 and Canadarm2 series of shuttle remote manipulator systems.

- **Remote sensing, telescopes, RADARSAT satellites, etc.**

  Remote sensing is the acquisition of object or phenomenon information without making physical contact in the observation. RADARSAT is a Canadian remote sensing Earth observation satellite program operated by the Canadian Space Agency (CSA). **In Grade 8**, remote sensing includes telescopes and RADARSAT satellites.

Learning to live sustainably contributes to scientific literacy by supporting people in solving complex interconnected problems related to socio-environmental systems and sustainability in communities. Contributions to scientific literacy include evidence-based argumentation, ethics in science, and understanding and application of science content knowledge. It also includes knowledge within other learning areas.

- **Correct use of equipment and tools**

  Correct and safe use of equipment and tools relates to sustainability through the preservation of resources and learning to use specific tools to collect appropriate data to solve complex problems. Awareness and accountability of safety increases awareness of actions and of impact. **In Grade 8**, correct use of equipment and tools include pulleys and spring scales.

- **Conducting field work and investigations safely**

  Field work is inherently risky. Conducting field work and investigations safety relates to sustainability through standardized procedures and ethical teaming. **In Grade 8**, conducting field work and investigations safely considers learners’ transition to more independent investigations with less educator direction, larger physical boundaries, and more open-ended exploration.

- **Space hazards**

  Space hazards describe hazards in space travel, living and working in space, and hazards originating from space. **In Grade 8**, space hazards include radiation, consideration of radiation sources and exposure, isolation and effects of loneliness and proximity, distance from Earth and logistical complications, gravity fields and long durations of time in microgravity, and hostile/closed space environments.

- **Human survival, zero-gravity**

  Space is a near vacuum environment, therefore human space travel and survival require technology and strategies. There is gravity in all areas of the universe including space, relative to distance and mass of objects. Human space travel and living require training in simulated weightlessness

environments on Earth. **In Grade 8**, human survival includes physical wellness and well-being and mental wellness. **In Grade 8**, zero-gravity includes human body systems and functions in simulated weightlessness training environments and subsequent space environments. The learning context may include questions such as, "How does the climate of Earth differ from other planets?"

- **History of space exploration**

  Space exploration is the application of astronomy and space technology to explore outer space. Development of rockets facilitated the physical exploration of outer space by probes and technology without humans on board and physical space exploration by humans. **In Grade 8**, history of space exploration includes successes, failures and milestones, and NASA, ESA, UN Space agency, and Canadian and international space partnerships.

- **Exosphere (space) traffic**

  The exosphere is a thin layer of atmosphere around a planetary body or satellite where the density is so low particles collide less often. On Earth, most human satellites orbit in the exosphere. Due to the number of human satellites in orbit, space traffic refers to orbiting conditions in Earth's exosphere. **In Grade 8**, exosphere (space) traffic includes reusable rockets and space junk, and defunct human made objects in space.

- **Cost-benefit analysis of space exploration**

  Space exploration requires national and/or international collaboration. It is expensive in terms of required economic currency, natural resources, and time. Space exploration decision-making implicates mathematics, technology, business, economics, and other domains. This connects within the Sustainability and Global Citizenship New Brunswick Global Competency, reflecting on and appreciating diverse worldviews and understanding and addressing social, ecological, and economic issues crucial to living in a contemporary, interdependent, and sustainable world.

- **Life and career pathways**

  The idea of career pathway planning is supported through evidence-based practices such as experiential learning, labour market information learning, social-emotional learning, global competency learning, and financial wellness learning. The Career Connected Learning K-12 framework complements and supports existing career education strategies. **In Grade 8**, life and career pathways include science literate citizens, astronauts, biomedical engineers, astrophysicists, computer/information systems scientists, science policy analysts, software engineers, project managers, space artists, etc.

- **Science and the UN Sustainable Development Goals 3, 9, 13, 17**

  In Grade 8, inquiry and science investigations apply technology and are framed by the United Nations Sustainable Development Goals 3 – Good Health and Well-Being, 9 – Industry, Innovation, and Infrastructure, 13 – Climate Action, 17 – Partnerships for the Goals.

- **Space technology and innovation used in everyday life**

  Space technology and innovation contribute to improved quality of human life on Earth through applications of technology and innovation or through development in space. **In Grade 8**, space technology and innovation used in everyday life include memory foam, computed tomography scan (CT or CAT), water purification systems, scratch resistant eyeglass lenses, etc.

- **Space technologies and climate change**

  Space technology is applied to collect data informing observations of climate change and climate science. **In Grade 8**, space technologies and climate change include Earth observation techniques, global environment monitoring, and remote sensing.

Unifying Ideas

Unifying ideas are a way to represent and organize and connect scientific knowledge during science instruction.

Unifying ideas for Science 6: Wayfinding and Making Sense of Your World context:

Energy: All physical phenomena and interactions involve energy. Energy is the driving force of both movement and change within matter. Learners analyse complex energy transformations and energy transformations at the molecular level.

Matter: Living organisms are made up of the same atomic components as all other matter. All the principles that apply to the structure of matter in the physical world, also apply in the living world. Recycling of matter involves the breakdown and reassembly of invisible units rather than the creation and destruction of matter.

Models: Physical and conceptual models support learning about abstract ideas. By creating models, abstractions become concrete and easier to understand. Physical models use hands-on approaches while conceptual models consist of mathematical representations of essential components and their interactions.

Systems: Systems, and the interactions that take place within and among them, make up the natural and constructed world. Whether a system is considered a system, or a subsystem, is dependent upon the scale of observation. Thinking about a whole in terms of its parts, and alternatively how the parts relate to one another, demonstrates higher order thinking.

Unifying ideas for the Science 7: Earth Surface Processes context:

Change: Changes in systems occur as steady trends, in cyclical fashion, irregularly, or in any combination of patterns. Recognising types of change depends on astute observation and critical analysis of systems.

Energy: All physical phenomena and interactions involve energy. Energy is the driving force of both movement and change within matter. Learners analyse complex energy transformations and energy transformations at the molecular level.

Equilibrium: When opposing forces or processes are balanced in static or dynamic ways, systems are in states of equilibrium. Systems where all processes of change appear to have stopped display constancy or stability. Systems where the rate of input into the systems are balanced by the rate of output, making the systems appear static, are in dynamic equilibrium. Systems where all processes of change have stopped, until something of enough magnitude disturbs or causes change, are in static equilibrium.

Matter: Organisms are linked to one another and to physical setting by transfer and transformation of matter and energy. Cycling of matter is found through levels of biological organisation, from molecules to ecosystems. Recycling of matter involves the breakdown and reassembly of invisible units rather than the creation and destruction of matter.

Unifying ideas for the Science 8: Beyond Earth: Human Presence in the Solar System context:

Energy: All physical phenomena and interactions involve energy. Energy is the driving force of both movement and change within matter. Learners analyse complex energy transformations and energy transformations at the molecular level.

Equilibrium: When opposing forces or processes are balanced in static or dynamic ways, systems are in states of equilibrium. Systems where all processes of change appear to have stopped display constancy or stability. Systems where the rate of input into the systems are balanced by the rate of output, making the systems appear static, are in dynamic equilibrium. Systems where all processes of change have stopped, until something of enough magnitude disturbs or causes change, are in static equilibrium.

Matter: Organisms are linked to one another and to physical setting by transfer and transformation of matter and energy. Cycling of matter is found through levels of biological organisation, from molecules to ecosystems. Recycling of matter involves the breakdown and reassembly of invisible units rather than the creation and destruction of matter.

Models: Physical and conceptual models support learning about abstract ideas. Models, regardless of type, represent simplifications of idea or processes. Physical models use hands-on approaches while conceptual models consist of mathematical representations of essential components and their interactions. As understanding of phenomena improves, models become more refined.

Essential Questions

Essential Questions provide a framework for exploration at each grade level. Answering the questions requires an in-depth analysis of the topic and could be explored in multiple ways. Below are some Essential Questions for each Middle Block Science grade. Though the questions provide guidance on how to explore the prescribed content at each grade, educators can co-develop Essential Questions with their learners.

Science 6: Wayfinding and Making Sense of Your World

- What role does energy play in enabling living things (especially humans) to sense their environment?
- How do we process different sensory stimuli (e.g., light, sound, different body position, etc.)?
- How do different living organisms process sensory stimuli?

- How does light (energy) behave in different materials?
- How does the interaction of our senses influence our perception of the world?
- How can light (or any other form of energy) be used to design innovative technologies that improve our lives?

Science 7: Earth Surface Processes

- What are Wabanaki Ways of Knowing or perspectives relating to local climate?
- How does thermal energy affect matter?
- How is energy transferred from one object or (between) system(s)?
- What factors interact and influence weather and climate?
- How does water influence weather, circulate in the oceans, and shape Earth's surface?
- What impacts are climate change (and severe weather) having on people, places, and ways of life in New Brunswick?

Science 8: Beyond Earth: Human Presence in the Solar System

- How can one describe physical interactions between objects and within systems of objects?
- How does our place in the universe impact how forces are experienced?
- Why is space a place to explore?
- How do we know Earth's global climate is changing?
- How does the challenges/constraints of living and working in space stimulate creativity?

SCIENCE STORYLINING

Next Generation Science Storylines: this website guides teams of educators and educator trainers in developing coherent 3-dimensional storylines for elementary, middle, and high school classrooms. "[A] storyline is a coherent sequence of lessons, in which each step is driven by [learners'] questions that arise from their interactions with phenomena. A [learner's] goal should always be to explain a phenomenon or solve a problem … Together, what [learners] figure out helps explain the unit's phenomena or solve the problems they have identified. A storyline provides a coherent path toward building disciplinary core idea and crosscutting concepts, piece by piece, anchored in [learners'] own questions." (Next Generation Science Storylines, 2018.)

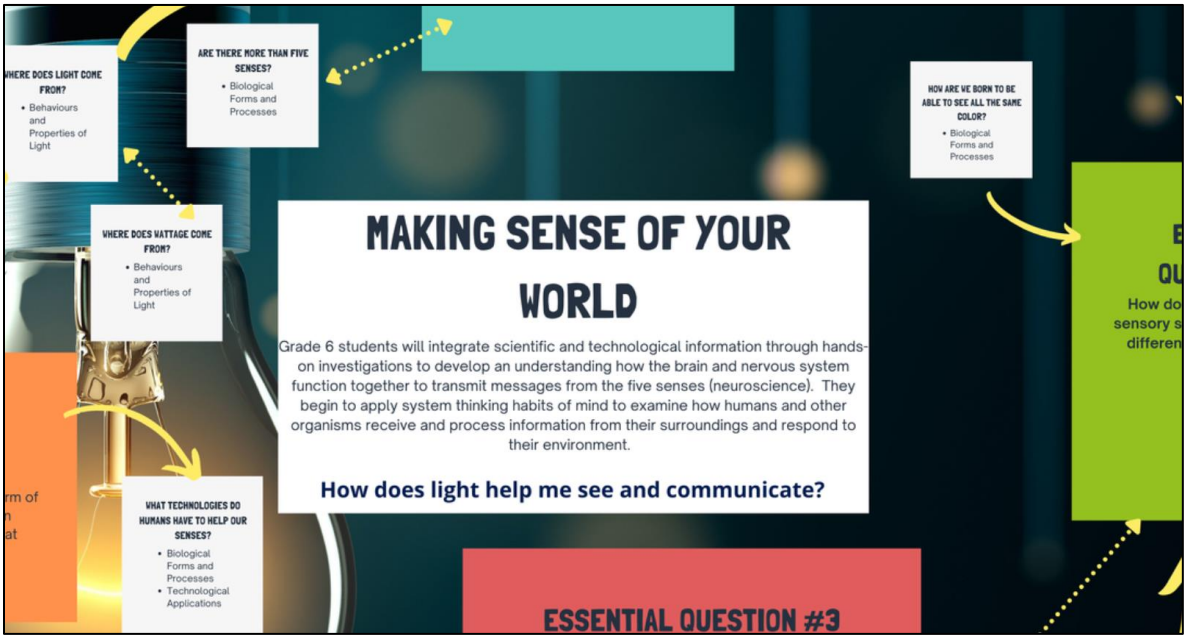
Professional Learning Hub: access to a wide range of ongoing professional learning opportunities, resources, and tools to enhance professional practice. Browsing the Brightspace section, or accessing the New Brunswick Virtual Learning Commons (NBVLC), gives New Brunswick educators access to *Grade 3 to 10 Science Curriculum PL*, district created science curriculum professional learning. This professional learning course provides a possible route through science curriculum Context and Concepts. The professional learning course also includes Essential Questions referenced in this companion document. All New Brunswick educators have access to Brightspace/NBVLC via NBED login credentials and must register in the professional learning course to gain access to the resources.

Science storylines are educator planning tools that provide possible pathways to frame inquiry and utilize science skills:

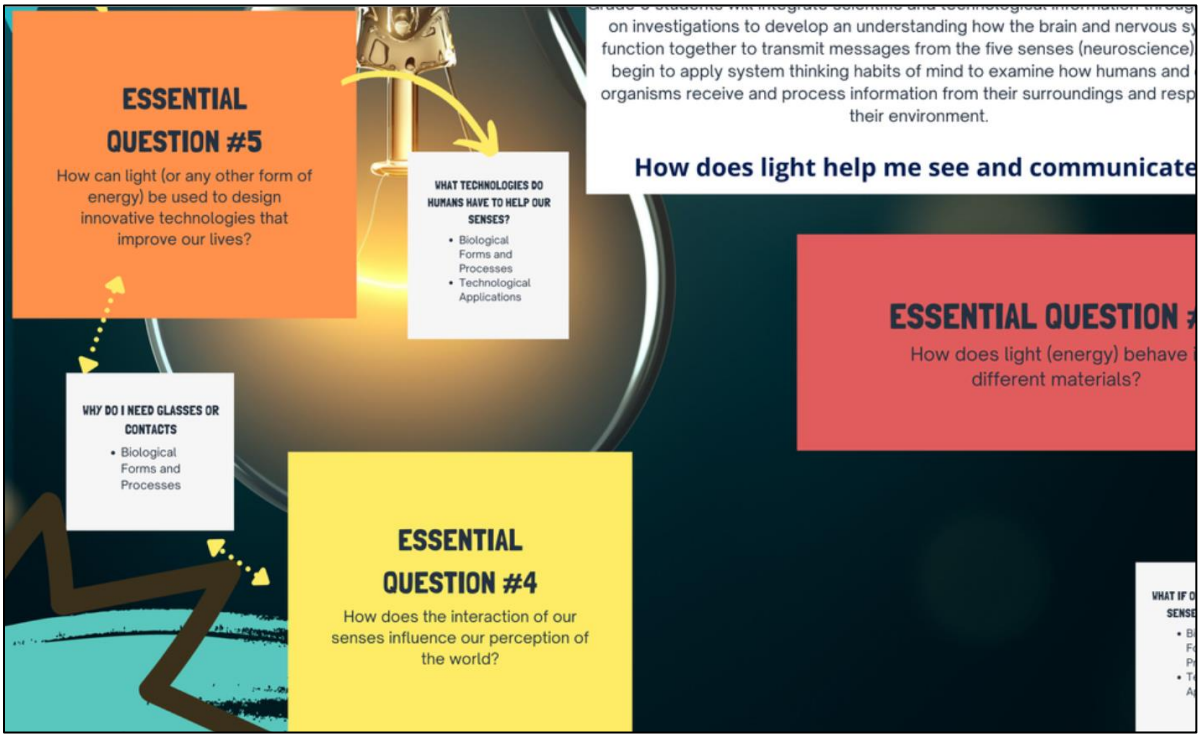
- Science 6 Storyline
- Science 7 Storyline
- Science 8 Storyline

The two following example images are taken from the Science 6 Storyline and highlight Essential Questions, pathway arrows, and list of science concepts included in each storyline.

Science storylines embed Essential Questions and visually indicate possible pathways to learning via arrows:



Each inquiry includes a list of related science concepts and lead to other related inquiry questions:



Assessment

For reporting on achievement of learning in New Brunswick, educators use a 4-point scale to communicate achievement for each curricular strand. Assessment of Skill Descriptors is informed by the evidence of learning outlined in the Achievement Indicators for each grade level and learning area. Skill Descriptors are end-of-year expectations. More information including report card guidelines can be found on the Assessing, Evaluating, Reporting Grades K-12 SharePoint site.

Examples of science formative assessment strategies:

Concept map	Investigation	Think-pair-share
Observation	Checklist/rubric	Quiz (low stakes)
Relay race	Response to text/activity	Classroom poll
Demonstration	Reflective scientific journal	Strategic questioning
Presentation	Self- and peer-assessment	Role play
Escape room	Career portfolio	Hand it in, pass it out
Technology applications	Entrance/exit slip	Mini whiteboards
Quick-extension project	Predict-Observe-Explain (POE)	Polly (Microsoft Teams)

LINGUISTICALLY INCLUSIVE ASSESSMENT

Consider the demands of your assessments. Are they measuring the content area knowledge and/or skills, as intended, or are they measuring language proficiency and reading skills? (Hyunh and Skelton, 2023).

Equitable assessment of learners still learning the language of the content area considers the following steps:

Use of Universal Design for Learning (UDL) Principles	Use of Scaffolds for Performance Based Assessments	Use of Scaffolds for Tests, Exams, and Quizzes
Provide opportunities for learners to demonstrate learning using multiple means of expression. For example: • Creating a photo essay • Creating a wordless picture book • Drawing a story map • Completing a concept map	• Provide templates. • Break down into steps and directly teach how to complete each. • Build in sequencing, instruction boxes, and sentence starters/frames. • Grade only for content knowledge and content-related language specifically taught.	Add the following supports: • Multiple choice • Matching • Sentence frames/sentence starters • Chunking • Images • Word banks • Simplified instructions

Science as a Way of Knowing

An inclusive science program recognizes that Western science, or Eurocentric science, are not the only forms of empirical knowledge about nature and aims to broaden learner understanding of ways of knowing the world. The terms "traditional knowledge" and "Indigenous Knowledge" are examples sometimes used when referencing Indigenous or local First Nation knowledge systems. The dialogue between scientific researchers and traditional knowledge holders continues, and there are examples of individuals who may self-identify or be welcomed within more than one group. Different ways of knowing the world may intersect when asking critical questions like,

- Whose research is it?
- Who owns the research or knowledge?
- Whose interest does the research or knowledge serve?
- Who will benefit from the research or knowledge?
- Who has designed the research questions and framed its scope?
- Who will carry out/who carried out the research? Who will write the research or knowledge?
- How will the research or knowledge be disseminated?

  (adapted from Smith, 2012 p. 10)

Enhanced science curriculum supports both Indigenous and Western methods, represents complementary, not separate, or conflicting realities, and broadens the purpose of science education to support nature literacy.

"Two-Eyed Seeing means to see with the strengths of both Indigenous and Western knowledges. At times, certain problems or situations require us to privilege one or the other world view. At other times, the two work together in harmony. The two perspectives are not inherently compatible. For most of us, at least for now, Two-Eyed Seeing requires a great deal of conscious effort to respect the differences between the two perspectives and to focus on, and work from, a position of shared strengths." (Marshall, Marshall and Iwama, p. 177)

INDIGENOUS WAYS OF KNOWING

Traditional knowledge is a cumulative body of knowledge, know-how, practices, and representations maintained and developed by Indigenous Peoples with extended histories of interaction with the natural environment (Battiste, 2013). These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, resource use practices, ceremony, spirituality, and worldview (adapted from International Council for Science, 2002 as cited by Restoule, 2019). As an example, "Our culture is based on oral histories, meaning that what we need to know is passed on from generation to generation through oral histories, mentorship, and hands-on learning experience. The Mi'kmaq used wampum, chewed birchbark, and wrote hieroglyphics; we also etched petroglyphs into stone as physical representations of information" (Mi'kmawey Debert Cultural Centre, 2015 p. 16). To be curious about this body of knowledge and way of knowing will enhance science learning.

SCIENTIFIC WAYS OF KNOWING

Scientific research, Western science, Eurocentric science, are cumulative bodies of knowledge, know-how, practices, and representations that are actively developed and curated by scientists. In mainstream society, some scientific bodies of knowledge are more widely known or valued, and some are less known or valued. To study the natural world, scientists use empirical methods, grounded in observations, and experimentation, and rely on types of evidence and testing.

Indigenous Ways of Knowing, Indigenous methods including observation, storytelling, connection of Indigenous Peoples to the land and ceremony, add value to scientific inquiry and scientific practices.

Resources to Support the Program

LABS AND ACTIVITIES:

Sample science activities have been included as suggestions to help support the program. Educators can use professional judgement to determine if these resources complement their teaching style.

Topic	Skill Descriptor	Link	Notes
Resource Bundles	---	EECD Resource Bundles	Lesson plan/PDF New Brunswick educator created resource bundles aligned to New Brunswick Curriculum Framework, big ideas, skill descriptors. Includes other learning areas.
Light Energy Behavior	Grade 6: Plan investigations to answer questions about relationships between and among variables observed in natural and technical sensory systems.	TE Engineering Light Stations (English)	Lesson plan/website Learners will discuss the phenomena of refraction, light is made up of waves, waves at different wavelengths create different colors, how a prism works, etc.
The Water Cycle	Grade 7: Plan investigations to answer questions about relationships between and among variables observed in matter and Earth surface processes.	Big Kid Science Earth and Space Science (English)	Lesson plan/website/e-textbook Inquiry question: How does water cycle through the hydrosphere and atmosphere?

The Water Cycle	Grade 7: Plan investigations to answer questions about relationships between and among variables observed in matter and Earth surface processes.	Let's Talk Science/Parlons-sciences What is the Water Cycle? (English) Qu'est-ce que le cycle de l'eau? (Français)	Lesson plan/website Learners design and create their own miniature model of the water cycle using simple materials as a way to demonstrate understanding of the process.
Ocean Pollution	Grade 7: Apply scientific and technological knowledge and an understanding of sustainable practices responsibly with respect to matter and Earth surface processes.	Resources for Rethinking/Ressources pour repenser Species at Risk Educator Guidebook (English) Species at Risk Student Workbook (English) Trousse Pédagogique Sur Les Espèces En Péril Guide De L'éducateur (Français) Trousse Pédagogique Sur Les Espèces En Péril Cahier De L'élève (Français)	Lesson plans/website/PDF Resources for Rethinking pairs with Ocean Wise resources. Learners discuss the humpback whale and climate change, the killer whale and ocean pollution, the great white shark and bycatch, the hawksbills sea turtle and plastic pollution, and the sea otter and loss of kelp habitat, and ways to take action to protect them.
Robotics and Space Technology	Grade 8: Communicate procedure, result, and conclusion using a variety of media and working collaboratively.	Canadian Space Agency/Agence spatiale canadienne Astrobot (English) Astrobot (Français)	PDF Learners acquire the basics of programming and building a robot while conducting space missions.

Topic	**Notes**
Grade 6 Ideas	• Explore principles of different optical devices. • Identify artificial sources of light and complete energy audits. • Explore principles of and observe images of objects in mirrors. • Explore principles of and observe images of objects through lenses. • Estimate and measure angles of incidence and reflection. • Design experiments that consider factors that affect pitch and loudness of sounds. • Record sound loudness data in different locations.

Grade 7 Ideas	• Observe and record weather and environment data over time. • Compare the same weather and environment data collected from different weather and environment data collecting instruments. • Create diagrams demonstrating relationships between energy, sun, water, land, evaporation, condensation and precipitation. • Use sequences to describe what happens when substances' temperatures are changed. • Evaluate concentration of solutions by using instruments such as hydrometers. • Apply measures of central tendency to graph tidal data and make tidal predictions. • Describe tools and technology used by meteorologists. • Design experiments to demonstrate how temperature differences create water currents.
Grade 8 Ideas	• Propose and justify explanations for shadow lengths. • Design, test, evaluate and modify wing shapes to achieve and improve lift. • Create diagrams to demonstrate how the shape of aircraft wings are changed during different periods of flight. • Model the Earth and Moon to demonstrate when the Atlantic provinces see full, half, new moons; experience high tide and low tides; experience solar and lunar eclipses. • Collect (observation) data and record moon phases each night. • Create and describe sequences of daily events aligned with corresponding positioning of the Sun. • Examine airplane and spacecraft designs noting features such as those that rely on atmosphere (large wings, engines, propellers) or indicate the craft may fly in space (small wings or rudders, fuel booster containers). • Describe differences between Earth and Moon orbits, and differences between planets and stars. • Demonstrate changing of star patterns over time.

Science Learning Environment Considerations

PHYSICAL SPACE

Science can be explored in multiple learning environments; outdoor learning is encouraged. When appropriate, consider alternative learning spaces where science Big Ideas and Skill Descriptors can be engaged such as outdoor classrooms, greenhouses and science labs. Risk assessment is encouraged and depends on school facilities and location, offsite risk assessments should be completed by lead educators. If partnered with external organizations for outdoor learning, request risk assessment.

The New Brunswick Environmental Network (NBEN) and Sustainability Education Alliance of New Brunswick (SEA) educational paper *Giving our Children an Experiential Edge - A Discussion Paper on Outdoor Learning in New Brunswick* provides additional information on outdoor education and can be retrieved via SEA-NB Documents.

The Walking Curriculum: Evoking wonder and developing sense of place (K-12) (ISBN: 978197354069) by Gillian Judson is an interdisciplinary resource for Grades K-12 educators. The activities are based on principles of Imaginative Ecological Education and can be applied across contexts. The resource is designed to engage learners' emotions and imaginations with local and natural cultural communities.

Educators must consider factors that pose potential risk or hazard to learners. Preventative steps educators can take include:

- **Focus activities**: identify specific outdoor learning activities that will be conducted including the location; clearly identify learning goals and curriculum skill descriptors.
- **Identify hazards**: identify potential hazards associated with the activities. Assess likelihood and severity of potential consequences. Hazards include uneven terrain, steep inclines, weather conditions, and potential encounters with wildlife. Review the learning location prior to taking learners. Outdoor locations change during different seasons and over time.
- **Risk level**: based on likelihood and severity of hazards, determine overall risk level associated with the activities. This identifies areas where additional precautions or risk management strategies are needed.
- **Safety plan**: safety plans should be shared with learners, guardians and relevant rightsholders or stakeholders before beginning outdoor learning activities.
- **Safety briefing**: before the activities, conduct safety briefings with learners to review safety plans and highlight specific risks or hazards.
- **Appropriate supervision**: ensure appropriate supervision during outdoor learning activities to minimize risk of accidents or injuries. This includes additional adults to monitor learners.
- **Appropriate equipment**: ensure availability of appropriate equipment for activities such as sturdy footwear, rain gear or sunscreen.
- **Weather**: be aware of weather conditions, react accordingly and adjust or postpone activities to ensure learner safety.
- **Plan for emergencies**: have plans in place for dealing with emergencies such as injured or lost learners during activities.
- **Post-activity review**: after the activity is over, conduct review of safety plans and risk management strategies to identify areas for improvement. This follows the cycle of plan, do, check, act, found in The Learning Cycle - Formative Assessment.

Outdoor learning activities require routines for management of learners in alternate classroom environments. Educators and learners should co-construct and practise routines, for example:

- Muster point: determine a designated muster spot for direct instruction, safety, and collaboration opportunities.

- Recall signal: establish a signal that will bring learners to the educator or the muster point (e.g., whistle, song, rhythmic clap, etc.)
- Boundaries: establish clear explicit boundaries for the learning space for all outdoor learning activities.

MATERIALS

A science materials list for Middle Block Science has been provided by Anglophone Sector school districts including items that may be provided in schools for science instruction or can be considered by schools for purchase with resourcing funds. These items, equipment, supplies, or consumables support instruction and delivery of science curriculum and inquiry-based learning:

Grade	Item Type	
General Materials	General	• Safety glasses • Recyclables for construction • Magnifying lenses • Plastic eye droppers • Beakers (sets of three sizes) • Beaker tongs • Graduated cylinders (two sizes) • Spot plates • Scoops • Stir rods • Beaker tongs • Digital scales • Meter sticks • Partial immersion thermometers • Stopwatches • Hot plates • Kilowatt meter (climate action) • Digital (WiFi/Bluetooth) microscope • 102 L Clear Plastic Tote
	Texts to support literacy	• Science Notebooks (Lori Fulton) (ISBN-13: 9780325005683) • Teaching Teens About Climate Change (ISBN-13: 9780993775369) • Connecting the Dots (Eng & French) (ISBN-13: 9781736195703) • Understanding Climate Change, Grades 7–12 (ISBN-13: 9781681406329) • Amusement Park of the Future: STEM Road Map

		(ISBN: 9781681404837) • Rainwater Analysis: STEM Road Map (ISBN: 9781681404509) • The Changing Earth: STEM Road Map (ISBN: 9781681404684) • Human Impacts on Our Climate: STEM Road Map (ISBN: 9781681404080) • Climate Change: The Science Behind Melting Glaciers and Warming Oceans with Hands-On Science Activities (ISBN-13: 9781619308992) • Sustainability Education: A Classroom Guide (ISBN-13: 9781350262072) • Défis biodiversité (ISBN-13: 9782815314817) • Défis économies d'énergie (ISBN-13: 9782815315548) • Défis zéro déchet (ISBN-13: 9782815313179) • Défis économies d'eau (ISBN-13: 9782815317443) • Des idées à l'école: Activités et projets pour contrer les changements climatiques (ISBN-13: 9782895440178)
Grade 6 Materials	Context specific	• LED flashlights • Laser pointer • Mirrors • Concave/convex mirrors • Neutralizing lens set • Double convex lens • Double concave lens • Refraction dish • Prism • Colour filter paddles • UV beads/energy balls
Grade 7 Materials	Context specific	• Pocket Lab Weather sensors • Water testing kit (pH meter, temperature sensor, etc.) • Density kit (class set)

Grade 8 Materials	Context specific	• Pulleys • Wooden wheels • Ping pong balls • Marbles • Toy cars • Wood blocks with eyelet hook • Spring scales • Syringes (two sizes) • Plastic tubing

CULTURALLY AND LINGUISTICALLY INCLUSIVE ENVIRONMENT

Culturally and linguistically inclusive environments are environments in which the variety of cultures (understood as "ways of being, knowing and doing," or what we do and why) and language skills and levels from which learners are approaching their education and the world, are recognized, respected, and honoured (NBEECD, 2020).

There are many actions educators take when enacting culturally and linguistically inclusive environments, but three key ones that span across all content areas are:

- Use of translanguaging
- Co-creation of classroom norms
- Environment as co-teacher

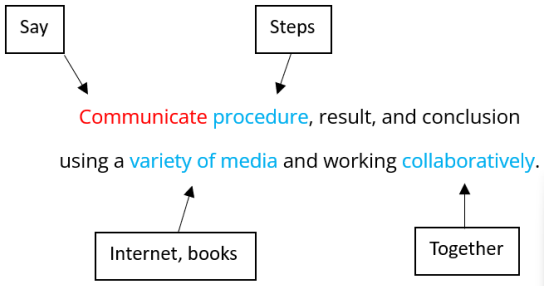
Translanguaging: strategically plan opportunities for **translanguaging**, allowing languages to work together to support learning. This can be achieved by alternating the language used during the input, processing, and output phases of a learning cycle (Crisfield, 2017).

Input	Processing	Output
Conduct research in home language.	Share learning with peers during group discussion in the target instructional language.	Scaffold by creating a report written in home language. Take main ideas from the report and then create an infographic or list main ideas in the target language.

Note for French Immersion Content Area Teachers: in both English Programs (EP) and French Immersion (FI), translanguaging should be employed strategically and intentionally, utilizing learners' prior knowledge from their home language to aid their acquisition of the target language and of content while celebrating classroom identities and diversity. A significant difference between EP and FI classrooms is that French is a minority language being taught in schools where English is the language of school-wide operations. For this reason, it is crucial that outputs of learners in FI classes are scaffolded into French and that they receive strategies to aid this process.

Co-creation of classroom norms: co-create class and group norms. Learners who are newcomers to New Brunswick may be operating with different sets of unwritten rules for what appropriate behaviour and learning systems should look like in a school setting. Co-creating norms makes expectations explicit and allows for diverse voices to be incorporated. Co-creating norms may also appeal to newcomers from more collectivist cultures where group harmony and contributing to a sense of community are valued.

Environment as co-teacher: strategically use classroom displays and routines to support learners with the language of science, such as:

Multilingual Word Walls	Anchor Charts	Annotated Objectives
Interactive word walls that change based on the topic, unit, or theme being studied. Include key words, terms, phrases in the target instructional language and the other languages spoken in the class.	Poster highlighting key ideas, processes, or concepts related to a particular skill or unit and supported by visuals	Objectives for each lesson are shared with students who work with teacher to annotate the academic vocabulary. 

Community Outreach/Curriculum Support

Name of Organization	Link	Notes
Association of Professional Engineers and Geoscientists New Brunswick (APEGNB)	APEGNB	The regulatory body for engineering and geoscience professionals and professionals in training practicing in New Brunswick or on provincial projects
Atlantic Coastal Action Program (ACAP)	ACAP Saint John	Climate Action resources and information. A community-based, non-profit organization that encourages communication, partnership, and active involvement from the community in managing the local environment.

Atlantic Canada Fish Farmers Association (ACFFA)	ACFFA	Information, career connections, educational resources. An industry-funded association providing advocacy and resource support services for the salmon aquaculture industry operating in Atlantic Canada.
BC Hydro	Power Smart for Schools	K-12 resources and lesson plans. Supports clean energy, including conservation, sustainability, safety, energy, and electricity.
Berkeley – University of California	Understanding Science	K-12 lessons and resources, and review tips for modifying your current instruction. Emphasizes nature and process of science.
Big Kid Science	Activities/Resources	Resources and activities. Links Earth and space exploration.
Brilliant Labs	Brilliant Labs Labos Créatifs	A hands-on experiential learning platform empowering youth to learn through the integration of creativity, innovation, and technology.
Canadian Geographic	Canadian Geographic Education Éducation Canadian Geographic	Lesson plans and activities. Includes Indigenous education resources, interactive maps, videos.
Canadian Space Agency	Youth and Educators Jeunes et éducateurs	Activities and projects by topic, grade level, and duration. Space activities and experiments developed by the Canadian Space Agency.
Carolina	Human Body Systems	Activities and PDFs. Resources for teaching about 11 human body systems.
Ducks Unlimited	Ducks Unlimited Canada Ducks Unlimited New Brunswick	Several project options. Link to the New Brunswick branch present for a more local approach. Provides guidance on how conservation, restoration, and management of Canada's wetlands take place.
Exploratorium	Exploratorium	Located in San Francisco, California, the Exploratorium is a public learning laboratory exploring the world through science, art, and human perception.

The Gaia Project	The Gaia Project Le Projet Gaia	Curriculum links, classroom visits, and hands-on projects.
Government of Canada	Biokits	Interactive kits and observation guides for exploring biodiversity. Activities broken down by geographic location in Canada and through the Trans Canada Trail.
Government of Canada	Educational Resources Ressources pédagogiques	Activity books, resources, and links to websites. Government of Canada site for teaching and learning science and technology.
Government of New Brunswick	Centres of Excellence New Brunswick	K-12 activities, lesson plans, career connections and in-class supports for the areas of Health, Energy, Entrepreneurship, and Digital Innovation.
Hammond River Angling Association	Education	Educational programs and tours, camps, and information. A non-profit environmental organization, whose mandate is to protect and preserve the New Brunswick Hammond River watershed through education, conservation, and community interaction.
Huntsman Marine Science Centre	Huntsman Education	Private, not-for-profit social enterprise with an oceans focused mission that also conducts world-class aquatic contract research services and supports education.
Khan Academy	Khan Academy Science	Khan Academy offers practice science exercises, instructional videos, and a personalized learning dashboard that empower learners to study at their own pace in and outside of the classroom.
Learning for a Sustainable Future	Learning for a Sustainable Future L'Éducation au service de la Terre	K-12 sustainable education resources and lessons plans.
Let's Talk Science	Let's Talk Science Parlons-sciences	K-12 classroom resources, STEM activities, professional learning, and project ideas.
Miramichi Salmon Association Inc.	Miramichi Salmon Association Conservation	In-class supports, educational programs, project ideas and partnerships.

National Science Teaching Association	National Science Teaching Association	Research-based professional learning, published books, four grade-range-specific journals, online journal, three e-newsletters, and NSTA Blog.
Nashwaak Watershed Association Inc.	Nashwaak Watershed	Information, K-5 field trips, and educational resources.
Nature NB	Nature NB Nature NB	K-12 information, classroom, and group programs. Education kits and educator resources.
National Energy Education Development	NEED	Professional Development, lesson plans, activities, resources bundles.
Nemours KidsHealth	How the Body Works	Videos, worksheets, and articles to explore human body systems.
Next Generation Science Storylines	NGSS	Storylining is a strategy to help organize the science inquiry process in the classroom.
Ocean Wise	Ocean Wise Ocean Wise	Lesson plans including activities, resources, videos targeted towards oceanography and climate change.
Science Buddies	Science Buddies	Video lessons, lesson plans, STEM classroom kits.
Science East	Science East	Located in Fredericton, NB. Contact for in-class and educational supports.
Science Journal for Kids	Science Journal for Kids	For grades 3-12, allows educators to filter articles by topic, language, reading level, and scientific method. All the articles in this library are peer reviewed.
Statistics Canada	Resources for Educators and Students Ressources pour les éducateurs et les étudiants	Projects, infographics, videos on data literacy.
University of Colorado Boulder	PHET	Simulations for learners and educators to explore, including variables.

University of Colorado Boulder	Teach Engineering	Multi-level lesson plans, hands-on activities, maker fun, for math, science and engineering learners and educators.
University of New Brunswick	Quartermain Earth Science Centre	Resources available on site, PL for teachers offered yearly, and opportunities for geologists to visit schools across NB.
United Nations Department of Economic and Social Affairs	Sustainable Development Goals	Detailed information, targets, indicators, and connections between the United Nations Sustainable Development Goals.
Vivify	Vivify STEM	Space exploration STEM activities and lesson plans, and space podcast.
Water Rangers	Water Rangers	K-12 lessons and resources, water test kits for purchase.
The Office of First Nation Education	World of Wisdom	First Nation contacts, resources, tutoring opportunities, PL offerings.
Youth Science Canada	Smarter Science Éduca sciences	Framework of science skills. Workshops, resources, national partner for STEM Fairs.

Glossary

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A

Absorption	Process in which light is absorbed and converted into energy.
Acceleration	Rate of change of velocity of objects with respect to time.
Adaptation	Processes by which organisms becomes better suited for their environments.
Aeronautics	Study, design and manufacturing of air flight-capable machines and the techniques of operating aircraft and rockets within the atmosphere.
Agriculture	The science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool, and other products.
Air	Invisible gas surrounding Earth, a mixture mainly oxygen and nitrogen.
Albedo	The portion of incident light reflected by a surface.
Aquaculture	Rearing of aquatic animals or the cultivation of aquatic plants for food.
Atmosphere	Envelope of gasses surrounding Earth or other planets.
Atom	Basic particles of chemical elements, generally of neutrons, protons, and electrons.
Auditory System	Sensory system for sense of hearing.

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B

Barometric Pressure	Atmospheric pressure is the pressure within the atmosphere of Earth.
Behaviours of Light	Dispersion: splitting of visible light into its component colours; absorption: when light is transformed into energy; transmission: movement of electromagnetic waves through objects.
Biochemistry Receptor	Chemical structures receiving and transmitting signals.
Biodiversity	Variety of life in particular habitats or ecosystems.
Biosphere	Regions of Earth's surface, atmosphere and hydrosphere occupied with living organisms.
Blizzard	Severe snowstorms characterized by strong winds causing blowing snow resulting in low visibility. The difference between blizzards and snowstorms is the strength of wind.
Boiling Point	Temperature at which the vapor pressure of a liquid equals the pressure surrounding the liquid and the liquid changes into a vapor.
Braille	Tactile writing system used by people who are visually impaired.
Brain	Center of the nervous system in all vertebrate and most invertebrate animals.

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C

Camera	Instrument used to capture and store images and videos, digitally via electronic image sensors, or chemically via light-sensitive materials such as photographic film.
Canadarm	Series of robotic arms used on the Space Shuttle orbiters to deploy, manoeuvre and capture payloads.
Canadian Space Agency (CSA)	National space agency of Canada.

Carbon Cycle	Series of processes by which carbon compounds are converted in environments involving incorporation of carbon dioxide into living tissue by photosynthesis and return to atmosphere through respiration, the decay of dead organisms and burning of fossil fuels.
Celestial Body	Naturally occurring physical entity or structure that exists within the observable universe.
Cell	Smallest unit of living organisms. The basic membrane-bound unit that contains the fundamental molecules of life of which all living things are composed.
Chunking	Dividing complex information into manageable chunks and/or dividing complex language into phases with words that would be grouped together by fluent English speakers/readers.
Climate	An area's typical weather conditions over time. Long-term patterns of weather in particular regions including temperature, air pressure, humidity, precipitation, sunshine, cloud cover and wind.
Climate Change	The ongoing increase in global average temperature and the effects on Earth's climate system.
Climate Literacy Principles	National Oceanic and Atmospheric Administration climate literacy principles provide a framework for teaching climate science.
Cloud Cover	Fraction of sky obscured by clouds on average at particular locations.
Coal	Combustible black or brownish-black sedimentary rock formed as rock strata called coal seams
Coast	The edge or part of land that meets ocean.
Colour Vision Deficiency (CVD)	Decreased ability to see color or differences in color including colourblindness.
Commodities	Raw material or primary agricultural product that can be bought and sold.
Compound Eyes	Visual organs found in arthropods consisting of small independent photoreception units.

Condensation	Change of state of matter from gas phase into liquid phase, the reverse of vaporization.
Conduction	The process of transmission of energy from one substance to another when the substances are in close contact.
Conservation	Preservation, protection, or restoration of natural environments.
Contact Force	Forces that occur as a result of objects making contact with each other.
Continental Crust	Earth's crust generally at depths of 30-50 kilometers.
Control	Elements that remain constant or stay the same in experiments.
Convection	Transfer of thermal (heat) energy through the movement of liquid or gasses.
Cooling Curve	Graphical representation of correlation between temperature and time, represents changes of phases of matter.
Crop	Cultivated plants grown as food, especially grains, fruits, or vegetables.
Cryosphere	Part of Earth's surface where water is in solid form.
Cycle	Series of events that happen repeatedly in the same order.

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D

Data	Collections of values or sequences of symbols conveying information, describing quantity, quality, fact, statistics, other basic units of meaning, etc.
Dependent Variable	Values, events, conditions, etc. depending on other variables in experiments.
Density	A substance's mass per unit of volume.
Disease	Abnormal conditions adversely affecting structure or function of all or part of organisms, not immediately due to external injury.

Dispersion	The separation of light based on its colour (wavelength).
Drag	Fluid resistance is force acting opposite to relative motion of objects moving with respect to surrounding fluid.
Drought	Periods of drier-than-normal conditions.
Dynamic Equilibrium	In chemistry, once a reversible reaction occurs. In physics, thermodynamic equilibrium, when reactions occur at rates where composition of mixtures do not change with time.

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E

Ear	Organ that enables hearing and body balance using the vestibular system.
Earth	Third planet from the Sun in the Solar System.
Earthquake	Any natural or human caused seismic event that generates seismic waves.
Earth's Crust	Top / outer layer of the structure of Earth. Two types: oceanic and continental crust.
Earth Cycles	Rock, tectonic plates and water changed within the Earth's surface.
Earth Systems	• Geosphere - consists of the interior and surface of Earth, made up of rocks • Biosphere – smallest layer of the planet that can support living things • Hydrosphere – portion of Earth covered in water • Atmosphere – layer that wraps Earth with gasses • Cryosphere – areas consisting of ice
Ecosystems	Communities of organisms interacting with each other and with abiotic factors in environments. Includes forests, waterways, coastal, and wetlands; and interactions between living and non-living components.
Electromagnetic radiation	The different kinds of energies released into space by stars, including radio waves, heat (infrared radiation) and light.
Electromagnetic Spectrum (EMS)	Measures energy travelling in waves and spans a broad spectrum of waves.

Electron	Subatomic particles with negative charge.
Energy	Quantitative property evident in the performance of work and the forms of heat and light.
Energy Conservation	Efforts to reduce wasteful energy consumption.
Energy Transformation	Process of energy changing from one form to another.
Environment	Surroundings and conditions inclusive to living and non-living things.
Equilibrium	State of balance, stability or regulation.
Erosion	Physical movement and deposition of soil, rock, and/or dissolved materials to new locations.
Exosphere	Thin atmosphere-like volume surrounding planets or natural satellites where molecules are gravitationally bound to the bodies but where the densities are so low that the molecules are essentially collision-less.
External Forces	Gravity, symmetry, and load acting on structures.
Extrapolation	Estimation finding new data points beyond the ranges of sets of known data points.
Evaporation	Vaporization that occurs on the surface of a liquid as it changes into the gas phase.
Evidence	That which confirms or disconfirms scientific hypotheses.
Eye	Sensory organ allowing organisms to perceive visual information.
Eyeglasses	Vision eyewear with lenses mounted in a frame holding them in front of a person's eyes.
Eyespot	Photoreceptive organelle found in green algae and other unicellular photosynthetic organism cells.

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F

Fair Test	Controlling and changing only one variable at a time in experiments, sound design and correctly conducted.

Farmers' Almanac	An annual American periodical providing long-range weather predictions for Canada and the United States.
First Law of Thermodynamics	A formulation of the law of conservation of energy in the context of thermodynamic processes.
Flood	Overflow of water that submerges land that is usually dry.
Fossil Fuels	Hydrocarbon-containing material formed naturally in the Earth's crust from the remains of dead plants and animals, extracted and burned as fuel.
Forces	Strength or energy as attributes of physical action or movement. For example, action at a distance that can influence the motion of objects.
Formation Processes	Solidification of magma, cooling of lava, heat and pressure, weathering, erosion, and deposition.
Freezing Point	The crystallization point is the temperature at which substances transition from liquid to solid,
Fresh Water	Any naturally occurring liquid or frozen water containing low concentrations of dissolved salts and other total dissolved solids.
Friction	Resistance to motion between two surfaces.
Fuel	Materials that can be made to react with other substances to release energy as thermal energy or used for work.

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G

Geosphere	Inner layer of Earth consisting of the surface all the way to Earth's core.
Global Positioning System (GPS)	Satellite-based radio navigation system owned by the United States government and operated by the United States Space Force.
Global Warming	The ongoing increase in global average temperature and the effects on Earth's climate system.
Gravitational Force	Fundamental interaction which causes mutual attraction between all things that have mass.

Gravity	A fundamental interaction which causes mutual attraction between all things that have mass.
Greenhouse Gases	Gases that are contained in atmosphere such as carbon dioxide, methane, nitrogen oxides and fluorine gases. These gases let light enter the atmosphere but trap some of the energy which warms Earth.
Greenhouse Effect	The collection of greenhouse gases in Earth's atmosphere.
Guide Dogs	Assistance dogs trained to lead blind or visually impaired people.
Gustatory System	Sensory system partially responsible for the perception of taste (flavor).

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H

Habitat	Immediate environments in which living organisms (animals or plants) exist.
Hail	Solid form of precipitation consisting of balls or irregular lumps of ice called hailstones.
Hazard	Potential sources of harm.
Hearing Aid	Device designed to improve hearing by making sound audible to people with hearing loss.
Heat	Quality of being hot, high temperature, refers to thermal energy.
Heating Curve	Graphical representation of correlation between temperature and heat input, diagrams which show the phase changes that occur when heat is added or removed from substances at constant rates.
Homeostasis	State of steady internal physical and chemical conditions maintained by living systems, the body's way of keeping internal conditions stable and balanced despite changes in external environments.
Human Body	Entire structure of human beings.
Human Systems	Collection of organs working towards the same means including digestive, respiratory, circulatory, nervous, and musculoskeletal systems.

Humidity	The concentration of water vapor present in the air.
Hydraulics	Technology and applied science involving the mechanical properties and uses of liquids.
Hydrosphere	Part of a planet made of water including oceans, rivers, lakes. and clouds.
Hypothesis	Proposed explanations for phenomena.

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I

Ice	Water frozen in solid state.
Igneous Rock	Formed through cooling and solidification/crystallization of magma or lava.
Images	Pictures, diagrams, illustrations.
Immersive Reader	A free tool with Microsoft programs designed to help users enhance and improve reading and writing skills.
Independent Variable	Values, events, conditions, etc. that do not depend on other variables in experiments.
Insolation	Solar irradiance is the power per unit area received from the Sun in the form of electromagnetic radiation.
Internal Forces	Tension, compression, torque, and shear.
Inference	Conclusion or plausible explanation based on evidence and prior knowledge.
Inertia	Tendency of objects to remain in current motion unless acted upon by outside forces.
Interpolation	Estimation finding new data points based on the ranges of sets of known data points.
International Space Station (ISS)	Large space station assembled and maintained in low Earth orbit by a collaboration of five space agencies: NASA (United States), Roscosmos (Russia), JAXA (Japan), ESA (Europe), CSA (Canada) and their contractors.
ISS Modular	The process of assembling the International Space Station (ISS) has been under way since the 1990s. The first ISS module was *Zarya*.

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J

Joule	Unit of measure for energy equal to Newton•metre (N•m)

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K

Kinetic Energy	Energy objects have based on speed and mass.

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L

Landform	Natural or anthropogenic land features on the solid surface of Earth or other planetary bodies.
Landslide	Forms of mass wasting that include ground movements, rockfalls, mudflows, shallow or deep-seated slope failures and debris flows.
Lava	Molten or partially molten rock that has been expelled from the interior of a planet onto the surface.
Law	Scientific laws are statements based on repeated experiments or observations describing or predicting natural phenomena.
Law of Conservation of Energy	The total energy of an isolated system remains constant. In closed systems, the total amount of energy within the systems can only be changed through energy entering or leaving the systems.
Life	Conditions that distinguish animals and plants from inorganic matter or non-living matter.
Light	Electromagnetic radiation that can be perceived.
Light Cycle	Refers to the cycle of light and darkness a plant receives. Different durations of light and darkness will affect how plants grow, whether they bloom or not and other elements.
Livestock	Farm animals regarded as assets.

Magma	Molten or semi-molten natural material from which all igneous rocks are formed.
Magnetic Force	Attraction or repulsion arising between electrically charged particles because of their motion.
Magnetism	Physical attributes occurring through magnetic fields which allow objects to attract or repel each other.
Mass	Measure of inertia, the resistance to acceleration (change of velocity) when net forces are applied.
Matter	Substance with mass and takes up space by having volume.
Mechanical Force	Direct contact between two objects (one applying the force and another which is in a state of rest or in a state of motion) resulting in the production of change in the state of the object.
Melting Point	The temperatures at which substances change state from solid to liquid.
Memory Foam	Developed by NASA, consists mainly of polyurethane with additional chemicals that increase its viscosity and density.
Metamorphic Rock	Rock formed from pre-existing rock from a combination of factors such as heat, pressure, and time. These rocks have transformed into new types of rocks. Original protolith rocks are subjected to high temperature and/or pressure causing physical or chemical changes, gradually recrystallizing to new textures or mineral compositions. Metamorphic rocks may be formed by tectonic processes, when rock is heated by the intrusion of magma, or deeply buried beneath Earth's surface subject to high temperatures and great pressure.
Meteorology	A branch of atmospheric science with a focus on weather forecasting.
Mineral	Solid inorganic substances of natural occurrence.
Mitigation	Reduction of something harmful. For example, mitigation strategies reducing the harmful effects of greenhouse gases.

Molecule	Group of two or more atoms held together by attractive forces.
Moon	A natural satellite of planet Earth.
Muscular Force	Contact force exerted by using body parts, produced by muscle action.

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N

National Aeronautics and Space Administration (NASA)	Independent agency of the United States federal government responsible for the civil space program, aeronautics research and space research.
Natural Cyclical Events	Includes sun and shadows, moon phases, ocean tides and seasons; seasonal weather conditions (changes in different locations at different times, cloud cover, temperature, wind direction, and precipitation); weather hazards (thunderstorms, floods, drought conditions, and blizzards); climate.
Natural Gasses	Naturally occurring mixtures of gaseous hydrocarbons consisting primarily of methane.
Natural Resources	Resources drawn from nature and used with few modifications.
Natural World	All living and non-living things occurring naturally, includes weather and climate, habitats, plants, and animals.
Navigation	Field of study, art or techniques that focus on monitoring and controlling the movement of crafts or vehicles from one place to another.
Near-Earth Object (NEO)	Small Solar System bodies orbiting the Sun whose closest approach to the Sun is less than 1.3 times the Earth–Sun distance.
Nerve	Enclosed, cable-like bundles of nerve fibers within the nervous system.
Nervous System	Highly complex part of animals that coordinate actions and sensory information by transmitting signals to and from different parts of its body.

Netukulimk	Concept of taking only what you need and preparing for future generations. Mi'kmaw word.
Neutron	Subatomic particles with neutral or no charge.
Newton's Laws	Three laws that describe the relationship between the motion of an object and the forces acting on it. 1st Law – An object remains at rest unless acted upon by an unbalanced force. 2nd Law - The acceleration of an object depends on the mass of the object and the amount of force applied. 3rd Law - Whenever one object exerts a force on another object, the second object exerts an equal and opposite on the first.
Non-renewable resources	Resources that are in finite quantity including coal, oil and natural gas (i.e., fossil fuels).
Nutrient	Substances providing nourishment essential for growth and the maintenance of life by organisms.

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O

Observation	Statement or comment based on using senses or assistive technology.
Ocean	Body of saltwater covering approximately 70% of Earth.
Oceanic Crust	Earth's crust generally at depths of 5-10 kilometers.
Ocean Current	Continuous, directed movement of seawater generated by a number of forces acting upon the water including wind, the Coriolis effect, breaking waves, cabbeling, temperature and salinity differences
Oil	Nonpolar chemical substances that are composed primarily of hydrocarbons, are hydrophobic and lipophilic.
Olfactory System	Sensory system used for smelling (olfaction.)
Organ	Collections of tissues with similar function.
Organism	Living things that function as individuals, that have organized structure and can react to stimuli, reproduce, grow, adapt and maintain homeostasis.

Perception	Organization, identification, and interpretation of sensory information to represent and understand information or environment.
Precipitation	Any product of the condensation of atmospheric water vapor that falls from clouds due to gravitational pull.
Phenomenon	Observable events.
Photosynthesis	Process by which green plants and some other organisms use sunlight to synthesize foods from carbon dioxide and water. Photosynthesis in plants generally involves the green pigment chlorophyll and generates oxygen as a byproduct.
Physical Properties	Colour, weight (mass and volume), density, grain size, texture, temperature, state (solid), conductor, insulators, solubility in water, mixtures, and solutions.
Periscope	Instrument for observation over, around or through objects, obstacles or conditions that prevent direct line-of-sight from current position.
Planet	Large, rounded astronomical bodies that are neither stars nor remnants. Planets form by accretion, growth by gradual accumulation of material driven by gravity.
Plasma	One of the states of matter, characterized by the presence of a significant portion of charged particles in any combination of ions or electrons.
Potential Energy	Form of stored energy in objects based on work done to it.
Pressure	Continuous physical force exerted on or against objects by things in contact.
Proprioception	Sense of self-movement, force, and body position.
Propulsion	Generation of force by combination of pushing or pulling to modify the motion of objects
Protected Agriculture	Cultivation of high-value vegetables and other horticultural crops in greenhouses – allows farmers to grow cash crops on small plots in marginal, water-deficient areas where traditional cropping is not viable.

Proton	Stable subatomic particles with positive charge.
Prototype	Sample, model, or release of product builds to test concepts or processes.

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Q

Qualitative Data	Recorded observations (e.g., yellow in colour, smooth texture.)
Quantitative Data	Recorded measurements involving numerical values (e.g., 30.0 cm, 15 kg.)

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R

RADARSAT	Canadian remote sensing Earth observation satellite program overseen by the Canadian Space Agency (CSA).
Radiation	Transfer of energy as electromagnetic waves or as moving subatomic particles.
Radiant energy	Energy of electromagnetic waves, a form of energy that can travel through space.
Rain	Liquid precipitation that falls toward the surface of Earth or other planetary bodies.
Recycling	Process of converting waste materials into new materials and can include recovery of energy.
Reflection	When light rays bounce off smooth surfaces, mirror-like.
Refraction	Redirection (change of angle) of waves (sound, light, etc.) through mediums.
Refractive Index	Number giving indication of the light bending ability of mediums.
Remote Sensing	Acquisition of information about objects or phenomenon without making physical contact.

Renewable Energy	Sources include solar, wind, water (hydro), thermal, plants and animals.
Rock	Solid mineral material forming part of the surface of Earth.
Rock Cycle	Describes transitions through geologic time among three rock types: sedimentary, metamorphic, and igneous.
Rocket	Vehicles that use jet propulsion to accelerate, producing thrust by reaction to exhaust expelled at high speed. Rockets engines work from propellant carried within the vehicle and can fly in the vacuum of space.
Rotation	Circular movement of objects around a central line, the axis of rotation.

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S

Salt Water	Saline water is water that contains a high concentration of dissolved salts.
Satellite	An object placed into orbit around a celestial body. Satellites have different uses including communication relay, weather forecasting, navigation (Global Positioning System), broadcasting, scientific research, and Earth observation.
Satellite Imagery	Images of Earth collected by imaging satellites operated by governments and businesses.
Scaffold/Scaffolding	The process of breaking lessons into manageable units, with the educator providing decreasing levels of support as learners grasp new concepts and master new skills.
Season	A division of the year based on changes in weather, ecology, and the number of daylight hours.
Seasonal Weather Conditions	Changes in different location at different time: cloud cover, temperature, wind direction and precipitation.
Sedimentary Rock	Rocks formed from pre-existing rocks or other non-living material. These rocks are formed by the deposition of mineral or organic particles at Earth's surface followed by processes that cause particles to settle in place. Particles that form sedimentary rock are called sediment.

Sensory Systems	• Vision (seeing) • Auditory (hearing) • Tactile (touch) • Gustatory (taste) • Olfactory (smell) • Vestibular (sense of balance) Proprioception (unconscious awareness of position of body parts)
Sentence Frames/Sentence Starters	Provides the framework for a complete sentence with blanks where learners will fill in their own words. Can be used to support oral and/or written expression.
Shadow	Dark area where light from a light source is blocked by an object, includes all the three-dimensional volume behind the object with the light source in front of it.
Shear	Strain in the structure of substances produced by pressure, when layers are laterally shifted in relation to each other.
Simple Machine	wheel and axle, pulley, inclined plane, screw, wedge, lever.
Simplified Instructions	Instructions provided in short, simple sentences with basic vocabulary.
Sleet	Precipitation consisting of ice pellets often mixed with rain or snow.
Snow	Individual ice crystals that grow while suspended in atmosphere then fall towards the surface of Earth or other planetary bodies, accumulating on the ground where they undergo further changes.
Soil	Collections of small pieces of rock that have been broken down by weathering and erosion over many years.
Soil Erosion	Removal of topsoil from the land surface. It is caused by water, wind, rain, and sometimes human activity.
Soil Porosity	Proportion of empty space in soils or rocks, directly proportional to the permeability of soils or rocks.
Soil Profile	Vertical section of soil from the surface to the parent rock or a depth of at least eight feet showing different horizons or layers that have been formed by soil processes, such as leaching and oxidation. It can be viewed by digging a pit or sampling soil.
Soil Types	Different categories of soil based on texture, particle size and composition. The main types of soil are sand, silt, clay, and loam.

	Other types of soil are derived from the combination of these main types, such as loamy sand, sandy clay, silty clay, etc. Soil can be classified by colour. Properties of each type of soil affect the growth of plants and the stability of structures.
Solubility	Ability or measure of a substance, the solute, to form a solution with another substance, the solvent.
Solution	Homogeneous mixtures composed of two or more substances.
Somatosensory System	Network of structures in the brain and body producing the perception of touch, temperature, body position and pain.
Sound	Vibrations propagating as acoustic waves through transmission mediums.
Solar System	Gravitationally bound system of the Sun and the objects that orbit.
Space	Outer space is the expanse beyond celestial bodies and their atmospheres. Space contains ultra-low levels of particle densities, a near-perfect vacuum.
Spacecraft	Vehicles designed to fly and operate in outer space.
Space Debris	Defunct human-made objects in space which no longer serve useful function.
Space Vehicle	Combination of spacecrafts and launch vehicles which carry them into space.
Spinal Cord	Long, thin, tubular structure of nervous tissue extending from the brainstem to the backbone of vertebrate animals.
Star	Luminous spheroids of plasma held together by self-gravity.
States of Matter	The forms in which matter can exist, four states of matter are observable: solid, liquid, gas, and plasma.
Static Equilibrium	Mechanical equilibrium occurs if net force on particle is zero.
Steering	Control of the direction of locomotion or components that enable its control.
Stewardship	Being sensitive to, developing sense of welfare for other people, other living things, and environment. Overseeing and taking care of the environment.

Stimulus	A thing or event that evokes specific functional reactions in organs or tissues.
Streak	Colour of mineral powder.
Sublimation	The transition of substances directly from solid to gas state without passing through the liquid state.
Sun	The star at the center of the Solar System.
Sunscreen	Photoprotective topical products for skin that helps protect against sunburn and prevent skin cancer.

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T

Tectonic Cycle	The lithosphere exists as separate and distinct tectonic plates which ride on a fluid-like solid asthenosphere, the tectonic cycle is geologic history characterized by sequences of tectonic and geologic events.
Telescope	Device used to observe distant objects originally using lenses, curved mirrors, or a combination of both.
Temperature	Quantitative expression of the attribute of hotness or coldness. A measure of the average kinetic energy of the particles of substances.
Tension	Action-reaction pair of pulling forces acting at each end of elements, opposite to compression.
Texture	Feel, appearance or consistency of a surface or substance.
Theory	Rational type of or result of abstract thinking about phenomena.
Thermal Energy	Can refer to different physical concepts, generally related to the kinetic energy of vibrating and colliding atoms in a substance.
Thermodynamics	The study of energy, its transfer into other forms, and interaction with matter.

Thunderstorm	An electrical storm or lightning storm characterized by the presence of lightning and the thunder acoustic effect on Earth's atmosphere.
Torque	Twisting force that tends to cause rotation.
Translanguaging	Using two or more languages together to support learning.
Translucency	Quality of allowing light to pass through so objects behind can be seen. Material components have differing indexes of refraction.
Transmission	When light hits transparent or translucent materials and light is able to pass all the way through.
Transparency	Quality of allowing light to pass through so objects behind can be distinctly seen. Materials have uniform indexes of refraction.
Transpiration	The process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers.
Trait	A genetically determined characteristic or condition.

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U

Universe	All of space and time and their contents.
UV Clothing	Clothing specifically designed for sun protection produced from fabrics rated for level of ultraviolet (UV) protection.

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V

Vaporization	Phase transition from the liquid phase to vapor, the reverse of condensation.
Vestibular System	Sensory system creating sense of balance and spatial orientation for the purpose of coordinating movement with balance.
Visual System	Ability to detect and process light.

Volcano	Ruptures in the crust of planetary-mass objects allowing hot lava, volcanic ash, and gases to escape from a magma chamber below the surface.
Volume	Measures of regions of three-dimensional space.

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W

Wabanaki Peoples	People of the Dawnland and includes Wolastoqey, Mi'kmaq, Penobscot, Peskotomuhkatiyik, and Abenaki. First Nations groups in the province of New Brunswick.
Wafting	Laboratory technique drawing one's hand across the opening of a container in order to push the odor towards the nose.
Water	Inorganic compound with the chemical formula H_2O.
Waterway	A navigable body of water.
Water Cycle	The path that all water follows as it moves around Earth in different states.
Weather	Patterns of seasonal change. The state of air and atmosphere at specific locations and time.
Weathering	Deterioration of rocks, minerals, soils through interactions with water, sunlight, atmospheric gasses, and/or organisms, grouped as physical or chemical weathering.
Weather Hazards	Significant weather systems or conditions which can be seasonal or unseasonal, including thunderstorms, floods, drought conditions and blizzards.
Weight	Relative mass or quantity of matter contained giving rise to downward force, i.e., the heaviness.
Weightlessness	Complete or near-complete absence of the sensation of weight.
Wind	Natural movement of gases relative to planet surfaces.
Word Banks	A written list of key vocabulary students can choose from to support oral and written output. Can be combined with sentence frames/sentence starters.

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X

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Y

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Z

Zero-gravity	A colloquial and inaccurate term used to describe weightlessness, which is the complete or near-complete absence of the sensation of weight.

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