Long Range Model 2 - Grade 4

STRAND A: STEM Skills and Connections	A1.1 Scientific Research	A1.2 Scientific Experimentation	A1.3 Engineering Design	A1.4 Safety	A1.5 Communication	A2. Coding and Emerging Technologies	A3. Applications Connections and Contributions

A1. STEM Investigation and Communication Skills: use a scientific research process, a scientific experimentation process, and an engineering design process to conduct investigations, following appropriate health and safety procedures

A1.1 use a scientific research process and associated skills to conduct investigations

A1.2 use a scientific experimentation process and associated skills to conduct investigations

A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems

A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials

A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes

A2. Coding and Emerging Technologies: use coding in investigations and to model concepts, and assess the impact of coding and of emerging technologies on everyday life

A2.1 write and execute code in investigations and when modelling concepts, with a focus on creating clear and precise instructions for simple algorithms

A2.2 identify and describe impacts of coding and of emerging technologies on everyday life

A3. Applications, Connections, and Contributions: demonstrate an understanding of the practical applications of science and technology, and of contributions to science and technology from people with diverse lived experiences

A3.1 describe practical applications of science and technology concepts in their home and community, and how these applications address real-world problems

A3.2 investigate how science and technology can be used with other subject areas to address real-world problems

A3.3 analyse contributions to science and technology from various communities

Term 1 Overview, Guidelines, Best Practice and Assessment Ideas:

Educators will be able to introduce and integrate Habitats and Communities throughout the year; this LRP contains several cross-strand STEM activities which allows students to continuously deepen their knowledge and understanding of the big ideas in Grade 4. Term 1 also focuses on Light and Sounds activities, with many opportunities for cross-strand and cross-curricular opportunities for students to deepen their understanding of the big ideas. STEM activities are an essential part of this LRP, and many options are provided for teachers to choose from that best suit their particular class, school, and community.

The nature of seasons, special events, and natural environments around us, helps educators to connect and deepen the understanding for students, especially when educators allow for cross-curricular integrations.

Inquiry and curiosity are important characteristics to foster in any learning environment. Engagement and motivation increase when students are encouraged to explore curriculum content in ways that are meaningful to them.

Creating a learning environment in which students feel safe, supported, and valued will help them voice their questions and ideas. There are many ways that educators can create such an environment, including

- Honoring students' background knowledge and inviting them to share what they know
- Becoming a co-learner with students when uncovering content guided by students' wonderings
- Encouraging students to ask good questions, and giving them the opportunity to find answers and/or solutions
- Supporting students as they carry out the scientific and engineering processes

Reflective Questions when Planning:

- What expectations are assumed in order for other expectations to be addressed?
- How might I revisit expectations at various times throughout the year?
- How can I create opportunities for students to continue to practice and consolidate learning when they are engaged in new learning?
- How will I use formative assessment to guide daily lessons?
- What materials, tools, and resources will be needed for each unit?

Strands & Expectations (in addition to the Strand A expectations listed at the beginning of this document):

B. Life Systems: Habitats and Communities

B.1 Relating Science and Technology to Our Changing World

B1.1 assess positive and negative impacts of human activities on habitats and communities, while taking different perspectives into account

B1.2 analyse the impact of the depletion or extinction of a species on its habitat and community, and describe possible actions to prevent such depletions or extinctions

B.2 Exploring and Understanding Concepts: demonstrate an understanding of habitats andcommunities and of interrelationships among the organisms that live in them

B2.1 describe habitats as areas that provide organisms, including plants and animals, with the necessities of life, and identify ways in which a local habitat provides these necessities

B2.2 describe a community as a group of interacting species sharing a common habitat, and identify factors that affect the ability of a community of plants and animals to survive in a local habitat

B2.3 describe the relationship of organisms in a food chain, and classify organisms as producers, consumers, or decomposers

B2.4 demonstrate an understanding of a food web as the interconnection of multiple food chains in a natural community

B2.5 describe how animals are categorized according to their diet, and categorize various animals as carnivores, herbivores, or omnivores

B2.6 describe structural adaptations of a variety of plants and animals and how these adaptations allow the organisms to survive in specific habitats

B2.7 explain why all habitats have limits to the number of plants and animals they can support

Month or Suggested Timeline	STEM Skills and Connections	Guiding Questions	Cross-Curricular Integration	Resources	First Steps & Next Steps
September **October** **November**	**NOTE:** Teachers should choose from this list of STEM activities that best suits their students, school, and community. **Food Chains and Webs:** students create mobile food chains using cue cards and string to show the connections between producers, consumers, and decomposers, as well as herbivores, omnivores, and carnivores; students then connect their chain to another chain from the same habitat and create a food web  **A1.3, A1.4** **Habitat Dioramas** Students use an engineering design process to learn about the habitats of animals they choose by constructing dioramas of their animal's habitats using recycled materials, boxes, construction paper, craft materials, etc.; students construct a poster that goes with their diorama to	Development of cities creates conditions that make it easier for some species such as the peregrine falcon to thrive. How could cities be designed to benefit more species? How can negative impacts on natural habitats and communities be minimized when farms/houses/malls are built? How could we design public areas such as parks to make sure Indigenous Peoples have access to medicines and ceremony spaces? How does the extinction of a species affect habitats, food webs, and food chains? Can humans reverse these extinctions? i.e. Polar bears have difficulty hunting (and die) as a result of less arctic ice caused by global warming (NEG.). Compare and contrast how needs are met for animals on a farm, pets in a home, and animals in natural spaces.	**Social Studies:** **Organic Farming Study:** students investigate issues related to herbicide and pesticide use and how organic farming practices are an example of a practical solution; students compare organic farming practices to farming practices used by First Nations, Metis, and Inuit as well as ancient civilizations; students present their comparisons by creating media works such as posters or presentations (Social Studies Heritage and Identity (A) and People and Environments (B)) **UN Sustainability Goals Connections Projects:** Students choose to study real-world problems and solutions, such as organic farming, habitat restoration projects, Ontario Species At Risk Act, etc., and investigate how the current UN Sustainability Goals were dealt with by past civilizations and how current Canadian Government Policies deal with	STAO Safety in the Elementary Science and Technology Classroom Invite a conservation Officer into class to talk with students to discuss the management and relationship between different plant and animal species. If available, invite an elder to come into the classroom to explain which animals are hunted for food, clothing, or tools. If possible, invite a beekeeper in to talk to students about the skilled trade of beekeeping. Resources to support outdoor learning and opportunities for teacher training. *Project Wild* by Canadian Wildlife Federation Learning for a Sustainable Future. Action Project funding	**First Steps:** This unit invites outdoor education and further consideration could be given to inclement weather, using the buddy system, and not eating delicious-looking berries without consulting an expert./additional outdoor safety guidelines. Outdoor education essentials also include asking students to bring in umbrellas, clipboards, and notebooks or collecting these items for use outside. Collection of materials for building projects is essential, and other objects such as cue cards, string, boxes, craft materials, pipe cleaners, and other materials such as recyclables for makerspace-type activities are important to consider. For construction, consideration may be given to collecting and/or purchasing glue guns, wood glue, balsa wood, and small saws.

	explain their habitat including the food web in it  **A1.3, A1.4** **Tree Study** Students use an engineering design process to choose a tree in their schoolyard or community. They take pictures of it in fall, winter, and spring, and collect data on it such as its approximate height (use thumb rule), the number of leaves, approximate age (using circumference), and any wildlife living on or near it. Students research why trees are an important habitat and present what they have learned about their tree in media works to the school community. Students may also want to get involved in planting a tree in their schoolyard if possible or creating a habitat including a tree as a garden area as an action project.  **A1.2, A1.3, A1., A1.5** **Pollinator Project** Students use an engineering design, and scientific	How could we include examples of "citizen scientist" initiatives that investigate the interdependence of plants and animals within a habitat? Can plants and animals still survive if their habitats are changed? What are the impacts on an Indigenous fishing community when water is polluted?	sustainability **Canadian Environmental Heroes study** Students create a digital or paper display that highlights important contributions of Canadian environmentalists or organizations (examples: David Suzuki, WWF, etc.) **Mathematics** Students use measurement devices for collecting data on trees. Students also tally animals and plants when walking in the schoolyard and/or community. **Language** Students can read about habitats by doing research as well as by providing books about habitats in the classroom. Students write and create media works as well as using oral communication when completing the various projects included in this unit plan. **Health and Physical Education:** Students go outside for a small walk around their recess	opportunities with resources for outdoor learning and UN Sustainability goals Learning for a Sustainable Future STEM Learning Challenges year-long activities and resources *STEM at School* by Let's Talk Science STEM kits and other supplies can be found at ● Kidder Canada ● Flinn Scientific Other lesson plans about sustainability and energy can be found in The World's Largest Lesson, Resources section.	**NOTE:** This unit can also be completed in the spring/summer - if wanting to plant a garden or tree, students can plan in the fall and plant later. Some trees and plants such as garlic or other bulbs such as tulips or daffodils can be planted in the fall for spring harvest. **Next Steps:** Start a class composter or your class can start a school composting program. This could also be started now at the beginning of the year to maximize effectiveness rather than waiting for the end of the year when studying rocks and minerals, and geological processes. Information on how to sign up with Ecoschools Canada can be found here. There are many resources here for waste audits, habitat and garden activities, etc. Visit an outdoor education centre or conservation centre if possible.

	experimentation process to study the role of local pollinators (butterflies, moths, bees, birds); create food chains including pollinators; design bees using craft/recycled objects with pipe cleaner legs to dip into crushed cheezies or powder that transfer the powder to crafted flowers; design a pollinator garden that could be implemented at school or build as models, taking specific needs of pollinators into account for the designed habitat; discuss safety surrounding pollinators (bees) and appropriate strategies for dealing with bees; communicate with the school community by creating posters of pollinators using student findings  **A1.1, A1.4, A1.5** **Canadian Species at Risk Projects** Students use a scientific research process to study and research the needs and habitats of a Canadian Species at Risk and design/build dioramas of its food chains in its habitat; students identify factors		yard, or nearby park. Students can explore and identify the habitats they discover and create a tally of their findings of plant and animal species in each habitat. Students can play a game of Freeze Tag while acting as their favorite species. Students can play the 'Predator and Prey' game - there are many versions of this game that you can find.		Invite a local guest speaker to talk about habitats and animals.

	contributing to the decline of the species and design possible solutions to those problems (examples: animal road crossings, plastic collectors in rivers, etc.); students communicate their findings by displaying dioramas and models of their solutions  **A1.3, A1.4, A.2** **Design & Build Bee Houses** Students use an engineering design process to research, design, build and test (in real life, or virtually) houses for solitary bees and use micro:bit technology to monitor the temperature. Students can also create media to describe the construction process using an algorithm.  **A.2** **Design a Habitat** Using CAD software and 3D printing technology, students design and create a naturalization area to enhance the habitat for a chosen Canadian species at risk.				

Strands & Expectations (in addition to the Strand A expectations listed at the beginning of this document):
C. Matter and Energy: Light and Sound

C1. Relating Science and Technology to Our Changing World: assess the impacts on society and the environment of technological innovations related to light and sound
C1.1 assess the impacts on society of devices that use the properties of light or sound, or both
C1.2 assess the impacts on the environment of light energy and sound energy produced by various technologies while taking different perspectives into account

C2. Exploring and Understanding Concepts: demonstrate an understanding of light and sound as forms of energy that have specific characteristics and properties
C2.1 identify a variety of natural and artificial light sources
C2.2 distinguish between objects and living things that emit their own light and those that reflect light from other sources
C2.3 describe properties of light, including that light travels in a straight path and that light can be absorbed, reflected, and refracted
C2.4 describe properties of sound, including that sound travels through a medium as a wave and that sound can be absorbed or reflected and modified
C2.5 explain how vibrations cause sound waves
C2.6 describe how different objects and materials interact with light and sound energy
C2.7 distinguish between sources of light that emit both light and heat and those that emit light but little heat
C2.8 identify sensory organs and devices that make use of the properties of light and sound

Month or Suggested Timeline	STEM Skills and Connections	Guiding Questions	Cross-Curricular Integration	Resources	First Steps & Next Steps
November December January	**NOTE:** Teachers should choose from this list of STEM activities that best suits their students, school, and community.  **A1.2, A1.4** **Prisms and Spoons Investigation** Students use a scientific experimentation process to use prisms and metal spoons (or other school materials) to explore how sunlight and artificial light travel. Students share what they have learned	Laws have been made and fines increased for texting and driving, yet statistics show it is still on the rise. What can be done to reduce this? Do you have to point a remote directly at an electronic device to activate it? What does this mean? Have you noticed what happens when a person yells at you/hits a baseball from across a field, or have you seen lightning first and then heard thunder? (i.e. light travels faster than sound)	**Social Studies:** **First Nations, Metis, Inuit, and Early Civilizations** **Sound and Light Investigation** Students research how First Nations, Metis, and Inuit used light and sound devices to communicate (e.g. drums), and how other early civilizations used similar communication devices; students describe how First Nations, Metis, Inuit and other early civilizations created light and sound devices that we	How would a sound engineer use the properties of materials to design a live theater or a movie theater? Invite a sound engineer in to discuss. If possible, invite a piano tuner to share his/her expertise in that skilled trade and/or invite an electrician to share his/her expertise in lighting.	**First Steps**: Collecting materials such as prisms, metal spoons, mirrors, tuning forks, salt, paper cups, string, and other school materials is helpful before starting this unit. Consider collecting milk cartons to make the periscopes, as well as other recyclable or found materials for making the musical instruments.

	by drawing diagrams of their observations.  **A1.2, A1.4** **Tuning Forks and Water/Salt** Students use a scientific experimentation process to investigate how sound moves in waves by striking a tuning fork and placing it in a cup of water or on a plate with salt on it, and recording observations.  **A1.1, A1.2, A1.4** **Cup Phones** Students use a scientific research and experimentation process to learn about sound waves by connecting 2 paper cups with a string and taking turns listening and talking into it in pairs. Students research parts of the ear and explain how the cups allowed them to hear using parts of the ear in their explanation. (C2.4 - C2.6, C2.8)  **A1.3, A1.4, A1.5** **Musical Instrument Inquiry Project** Students use an engineering design process to research how to design and build	Can you explain why you hear the sound of a train or plane passing after it has already gone by? Find a quiet place and stay still and silent to experience the sounds for five minutes. Use a video or audio recording app to capture the sounds. How do you feel the sounds are created? Return to the same space at a different time or on a different day. How did the sounds change? How might you use what you know about sound or about light and mirrors in your device? Which properties of light or sound will be most useful to you in your device? What challenges might you encounter, and how can you overcome them? Listen to sounds that you can hear in your schoolyard. Which sounds are natural? Which are human-generated? Can sources of light be both natural and artificial? Do some sources of light emit heat? The northern lights or aurora borealis are a magnificent light display visible in the northern regions of Ontario. What kind of	still use today (examples: drums and other instruments invented and used, ‘qulliq’ - Inuit lamp, Dendera light bulb from Ancient Egypt) (Social Studies Heritage and Identity (A) and People and Environments (B) **Soundproofing Inquiry:** Students research sound pollution and damage to ears caused by loud sounds; students design, build and test a soundproof box that will muffle sounds; students communicate their findings with posters and displays of what they have learned. **Arts**: Music: students create instruments and play together to share a song **Language** Students can read about light and sound when they research. Students write, create media works, and use oral communication when completing STEM projects and experiments. **Protecting our Eyes and**	STEM Learning Challenges year-long activities and resources *STEM at School* by Let’s Talk Science STEM kits and other supplies can be found at ● Kidder Canada ● Flinn Scientific Canada	A UV garden would be a great asset if doing the plants project with light. Find coding activities such as Scratch in order to create music using code. Some other sites include Tynker and Dance Party on Code.org. **Next Steps:** Students start a Lights Off Campaign at their school to help with energy conservation and do an energy audit in their school. Check out Canada Ecoschools for resources.

	drums, guitars, and other simple instruments using recycled or other approved materials; students design, build and test a simple instrument that will play a song; students can share their instruments by recording themselves or creating a class show.  **A1.4** **Light and Plants Inquiry** Students use an engineering design, scientific research, and experimentation process to investigate why plants need light to grow; students design and conduct experiments to test if UV gardens or other light sources will stimulate plant growth versus sunlit areas; describe the difference between natural light and light sources that emit heat versus those light sources that do not emit heat and how those differences can affect plant growth.  **A1.1, A1.3, A1.4** **Build a periscope or kaleidoscope** Students use an engineering design and scientific research	light are they? Have you noticed what happens to the sound of a car as it drives by at high speed or a low-flying plane? How do our eyes sense and respond to light? How do optometrists use tools to see the different components of our vision? How do sound and light detectors help improve the lives of people who have hearing or vision challenges? What might you invent to help further? What is the difference in the light we receive on Earth between the moon and the Sun?	**Ears Research Project** Students research various ways that sound and light can cause damage to our ears and eyes, and ways that we have developed to counteract this damage (e.g. ear plugs, noise-canceling headphones, blue light glasses, etc.); students prepare a report, poster, presentation, or media work about what they have learned. (Reading, Writing, Oral Communication, Media) **Animal Senses** Students research how various animals such as bees and dogs see and hear differently (e.g. different pitches, different spectra) and how these adaptations help them survive and find food. Students prepare a media work with their findings such as a poster or multimedia presentation. **Light and Sound in Cities** Students explore how light and sound pollution in cities affects animals living in and around cities. Students produce a report either digitally, coded, or written with their findings and share it with their classmates.		

	process to research the uses of mirrors in periscopes, telescopes and microscopes; students design, build, and test a milk carton periscope following proper safety procedures; students draw the path of light as it goes through the periscope into their eyes and research/explain how the light goes into their eyes and into their brains; describe the differences between objects that make their own light and those that reflect light.  **A.2** **Code a Song with Light Show** Students use a block-based code platform like Scratch to code a song of their creation that has a visual representation to go with it  **A1.2, A1.3, A1.4** **Find Your Blind Spot Activity** Students use an engineering design and scientific experimentation process to find their blind spot.				

	 **A1.2, A1.3, A1.4** **Eye Protection Activity** Students use an engineering design and scientific experimentation process to investigate ways to protect their eyes.				

Term 2 Overview, Guidelines, Best Practice, and Assessment Ideas:

Educators will be able to introduce and integrate Machines and Mechanisms throughout this term and connect to prior learning; this LRP contains several cross-strand STEM activities which allow students to continuously deepen their knowledge and understanding of the big ideas in Grade 4. Term 2 also focuses on Rocks, Minerals, and Geological Processes, with many opportunities for cross-strand and cross-curricular opportunities for students to deepen their understanding of the big ideas. STEM activities are an essential part of this LRP, and many options are provided for teachers to choose from that best suit their particular class, school, and community.

The nature of seasons, special events, and natural environments around us, helps educators to connect and deepen the understanding for students, especially when educators allow for cross-curricular integrations.

Inquiry and curiosity are important characteristics to foster in any learning environment. Engagement and motivation increase when students are encouraged to explore curriculum content in ways that are meaningful to them.

Creating a learning environment in which students feel safe, supported, and valued will help them voice their questions and ideas. There are many ways that educators can create such an environment, including

- Honoring students' background knowledge and inviting them to share what they know
- Becoming a co-learner with students when uncovering content guided by students' wonderings
- Encouraging students to ask good questions, and giving them the opportunity to find answers and/or solutions
- Supporting students as they carry out the scientific and engineering processes

Reflective Questions when Planning:

- What expectations are assumed in order for other expectations to be addressed?
- How might I revisit expectations at various times throughout the year?
- How can I create opportunities for students to continue to practise and consolidate learning when they are engaged in new learning?
- How will I use formative assessment to guide daily lessons?
- What materials, tools, and resources will be needed for each unit?

Strands & Expectations (in addition to the Strand A expectations listed at the beginning of this document):

D. Structures and Mechanisms

D1. **Relating Science and Technology to Our Changing World:** evaluate the impacts of various machines and their mechanisms on society and the environment

D1.1 assess the impacts of machines and their mechanisms on the daily lives of people in various communities

D1.2 assess and compare the environmental impacts of using different machines designed for similar purposes

D.2 Exploring and Understanding Concepts: demonstrate an understanding of the basic principles and functions of machines and their mechanisms
D2.1 identify machines that are used in daily life, and describe their purposes
D2.2 identify the parts of various mechanisms and describe the purpose of each part
D2.3 describe how different mechanisms transmit various types of motion, including rotary motion, from one system to another
D2.4 describe how mechanisms transform motion, including how they can change the geometric plane in which the motion occurs and the speed and/or direction of motion
D2.5 explain how forces are changed in a variety of machines

Month or Suggested Timeline	STEM Skills and Connections	Guiding Questions	Cross-Curricular Integration	Resources	First Steps & Next Steps
February March April	**NOTE:** Teachers should choose from this list of STEM activities that best suits their students, school, and community. **A1.1** **Machines Treasure Hunt** Students use a scientific research process to explore their classroom, school, and schoolyard looking for simple machines such as pulleys, gears, levers, etc. Students tally their findings and compare what they observe. Students explore simple machines that the teacher provides such as a stapler, kids toys, pulley, and gear pieces from a kit if possible, and research/describe how each part works.	How has modern transportation made parts of the country more accessible to northern Indigenous communities? How can the gears and pulley systems in amusement park attractions change the speed or direction of the ride? How does a bicycle use simple machines and systems to make it easier to travel uphill? What do you think the purpose of the gears inside this toy is? What might they look like? What were some of the first historical uses for machines and their mechanisms and other simple machines?	**Social Studies:** **Bikes Around the World Inquiry:** Students research how bikes use gears, bike use around the world, and the evolution of the bicycle; students compare the bicycle to other modes of human-powered transportation used by early First Nations, Inuit, Metis, and other early civilizations; students participate in raising awareness of the issues related to pros and cons of human-powered transport by communicating their learning in various media forms (Heritage and Identity A, People and Environments B) **Machines and their Mechanisms - Past, Present and Future Inquiry** Students research the uses of	STEM Learning Challenges year-long activities and resources *STEM at School* by Let's Talk Science STEM kits and other supplies can be found at • Kidder Canada • Flinn Scientific Canada An interactive machines and their mechanisms coding activity from Science North. GearSketch is an app that can be downloaded as well for online gear activities.	**First Steps**: Collection of items for observing machines and their mechanisms, as well as other simple machines, can include eggbeaters, can openers, kid's toys, and clocks. Teachers may also want to ensure that their school has adequate supplies of pulleys and/or gears to use for experiments. Sets can be found at Kidder.ca. Spools can be substituted for pulleys as well. Gears can also be made from cardboard, and templates can be found online. Other items for building may include makerspace items such as balsa wood, glue guns, wood glue, cardboard, and recyclable objects which

	 **A1.2, A1.3, A1.4** **Gear and Pulley Explorations** Students use pre-made or cut-out gears to investigate rotation speed and direction; students use a variety of pulleys to investigate how pulleys are used to lift objects and transfer forces.  **A1.2, A1.3, A1.4** **Mechanical Arm Activity** Students use an engineering design, scientific research, and experimentation process to research how mechanical arms, like the Canadarm, work; they design, build and test a mechanical arm using pulleys, gears, and simple machines that will pick up and move an object; students communicate their understanding by drawing and labeling the parts of their arm and describing how their arm could benefit someone.  **A1.2, A1.3, A1.4, A1.5** **Drawbridge Activity:** students use an engineering		pulleys, gears, and other simple machines in early First Nations, Inuit, Metis, and other early civilizations (e.g.: drawbridge, Cowichan spindle whorl) and compare the early uses to machines using simple machines today (e.g. cranes, electric screwdrivers, watches); students describe how simple machines are still used to make work more efficient; students choose a current issue that could be solved by designing a machine to help with that issue (examples: environmental, human health, construction on the Moon/Mars) **Language** Students can read about Mechanisms and Simple Machines when researching and also with provided books about this topic. **Machines and their Mechanisms Research Activity** Students research a famous drawbridge or how a sailboat or crane uses pulleys or how a watch or bike uses gears; students prepare works about their research such as		can also be collected in advance. **Next Steps:** Earth Month activities and initiatives such as yard cleanups, waste reduction challenges, and Earth Day activities can be implemented. Check out the website at Earth Day Canada for more ideas: Suggestions of activities Earth Day Canada Other lesson plans about sustainability and energy can be found in The World's Largest Lesson, Resources section. If possible, invite a small engine repair technician to share his/her expertise.

	design and scientific experimentation process to complete a STEM challenge to see if they can build a working drawbridge using both machines and their mechanisms in their design; students use recyclable materials, cardboard, and machines and their mechanisms as supplied by the teacher; students communicate their learning by demonstrating their bridges to the class and explaining how each part of their system works.  **A1.2, A1.3, A1.4** **Mining for Rocks** Students use an engineering design and scientific experimentation process to design, build and test a device that will lift a rock 1m using pulleys, gears, or other simple machines. Students also research how mining machines use machines and their mechanisms to extract minerals, and how those machines impact the environment around them.		posters, reports, or presentations such as a short slideshow (Reading, Writing, Oral Communication, Media) **Math** Students use tallies to find simple machines and analyse their data.		

Strands & Expectations (in addition to the Strand A expectations listed at the beginning of this document):
E. Earth and Space Systems

E1. Relating Science and Technology to Our Changing World: assess the social and environmental impacts of geological processes and of human uses of rocks and minerals
E1.1 analyse ways in which geological processes impact society and the environment
E1.2 assess social and environmental impacts of extracting and refining rocks and minerals and of manufacturing, recycling, and disposing of products derived from rocks and minerals, while taking various perspectives into account

E2. Exploring and Understanding Concepts: demonstrate an understanding of rocks, minerals, and Earth's geological processes
E2.1 explain geological processes that result in the formation of igneous, sedimentary, and metamorphic rocks, using the rock cycle
E2.2 describe the physical properties of igneous, sedimentary, and metamorphic rocks
E2.3 classify different rocks and minerals according to their composition and physical properties, using various tests and criteria
E2.4 describe everyday uses of rocks and minerals
E2.5 describe how fossils are formed and what information they can provide about Earth's history
E2.6 demonstrate an understanding of First Nations, Métis, and Inuit geological knowledges that are used in the selection of different rocks and minerals for specific purposes

Month or Suggested Timeline	STEM Skills and Connections	Guiding Questions	Cross-Curricular Integration	Resources	First Steps & Next Steps
April **May** **June**	**NOTE:** Teachers should choose from this list of STEM activities that best suits their students, school, and community. **A1.2** **Sort, Classify, and Re-sort Activity** Students use a scientific research and experimentation process to sort a variety of rocks according to their own sorting method, and explain their methods to each other; students research and identify the rock samples using	How is soil used in our environment and/or daily lives? (e.g., soils that help drainage around the house, septic bed, drinking water filters). How does soil clean water? Speak to experts to learn about how soil cleans water. What can you observe about the texture, clumping, and water drainage of each soil type? What might that mean about the use of each soil type?	**Social Studies:** **Recycle or Reuse Inquiry** Students collect various recyclable items and repurpose them to have other uses (design, build and test); students investigate the pros and cons of reusing/repurposing items versus recycling them (e.g. cost factors) and investigate the effectiveness of collection programs for aluminum, glass, and plastic bottles, as well as other solutions such as using plant-based alternatives for packaging; students	Outdoor Education Links to be used throughout the year: Resources to support outdoor learning and opportunities for teacher training. *Project Wild* by Canadian Wildlife Federation Learning for a Sustainable Future: Action Project funding opportunities with resources for outdoor learning and UN Sustainability goals	**First Steps**: Ask students to bring in rock samples safely to school and start collecting samples of sedimentary, igneous, and metamorphic rocks if possible or check to see if your school has some rock collections to use. Check also for rock testing items such as scratch test plates. Fossil kits may also be available. Collecting items such as salt, sugar, glass bottles, recyclable plastics and aluminum foil

	common characteristics, as well as other methods such as scratch tests, and re-sort their rocks using common characteristics (igneous, metamorphic, and sedimentary)  **A1.2** **Growing Crystals Activity** Students use a scientific research and experimentation process to research crystal formation in various types of rocks; students grow crystals using a variety of methods and compare results (example: sugar crystals versus salt crystals); students communicate their results by displaying results as a media work  **A1.1, A1.5** **Fossil and Rock Hunt** Students use a scientific research process to walk around the schoolyard or community and keep a tally of the different types of rocks they find or if they find any fossils; they also look for uses of rocks or minerals in their school, school yard or community and keep a tally of	Where might you observe these different types of soils? What living things can live in this type of soil? How do terrariums, school gardens, and home gardens provide shelter and/or nutrients for different kinds of living things? How can we preserve natural resources? In what ways have the resources in our community changed over time? What is our responsibility to the environment? What are the differences between the different types of rocks? What is the rock cycle? How are fossils formed? What can we learn from fossils? How do different types of technology for mining affect the environment? What can we do to help conserve mineral resources and protect habitats?	communicate their findings by creating media works showing their research findings and their repurposed items; students organize and participate in a collection program at their school, such as collecting aluminum cans to donate funds to a local charity (People and Governments B) **Can You Dig It Inquiry:** Students extract a resource by 'mining for beans' in a container of sand. They design, build and test a method for extraction with the least amount of contamination to the resource, the least use of other resources, and the least waste. Students research the use of metals in our everyday lives and where those metals can be found in Canada and the world, how they are extracted, and issues surrounding their extraction (example: mining tailings, etc). Students examine traditional uses of metals by First Nations, Metis, Inuit, and other early civilizations, and how they extracted the metals. Students propose solutions and design possible technologies to limit pollution	Learning for a Sustainable Future Student STEM Learning Challenges year-long activities and resources *STEM at School* by Let's Talk Science STEM kits and other supplies can be found at ● Kidder Canada ● Flinn Scientific Canada Students research issues related to mining and extraction of resources, examples: tailings and water pollution related to mining, habitat destruction and deforestation related to mining, etc. Mining Matters Activity: The Most Delicious Mine | Royal Ontario Museum	items, sand, beans, cardboard, and other makerspace items is encouraged. The Make Your Own Fossil activity needs items like coffee grounds, coffee, flour, and parchment or waxed paper. **Next Steps:** Outdoor education can be included easily in this unit. Your class can go for walks around the schoolyard and community to look for types of rocks and how rocks are used in buildings. Start a class composter or your class can start a school composting program. This could also be started at the beginning of the year to maximize effectiveness. Invite a rock collector to share his/her collection. Visit a local rock quarry if possible. If possible, invite a gemologist, jeweller, or miner to share their expertise in their skilled trades.

	what they notice; students discuss their findings and write down their observations  **A1.1, A1.2, A1.4, A1.5** **Cans and Bottles Investigation** Students use a scientific research and experimentation process to research how pop cans and pop bottles are manufactured; students research the process of how cans and bottles can be recycled into new ones; students do experiments with glass bottles such as making music by filling glass bottles to different heights and changing the sound of them; students do experiments with cans such as putting several different types of pop into a tub of water to see if any float or sink; students share what they have learned and observed by creating a poster or slideshow showing facts about manufacturing recycling, and experiments with pop bottles and pop cans		from mining. (Heritage and Identity A, People and Environments B) **Language:** Students read about rocks and minerals, and geological processes when researching. Students debate the pros and cons of mining in a debate format or by writing a report stating the student's opinion with facts to back up his/her opinion. **Rock Cycle Comics** Students create a comic strip showing the rock cycle and the process by which rocks change form using speech bubbles to describe each stage; students can use a coding platform like Scratch to create their comic or use paper; students share their comics with their classmates (Reading, Writing, Oral Communication, Media) **Pet Rock Project** Students find a special rock and build it a home using found objects; students write stories about their pet rocks and adventures their rocks have with other pet rocks;		

	 **A1.2, A1.4** **Make Your Own Fossils** Students use a scientific experimentation process to use a method for students to make their own fossils and investigate how fossils are made and what we can learn from them - recipes can be found online.  **A1.1, A1.3, A1.4, A1.5, A.3** **Rock Garden Project** Students use an engineering design and scientific research process to design and build a rock garden in the schoolyard or in the classroom; students investigate which types of plants do well in a rock garden and how plants use soil to grow; students share what they have learned by taking pictures of their garden and creating a media display showcasing the rocks and plants they chose.  **A1.1** **Rocks, lights, and sound waves Investigation** Students use a scientific research process to research		students read each other's stories; students can also create their stories using block coding such as Scratch or making comics or digital stories (Reading, Writing, Oral Communication, Media) **Math** Students use math during tallies to collect and analyse data. Students use math skills such as measuring and calculating area and perimeter to create a rock garden.		

	how light and sound technology is used to identify and locate mineral specimens and resources; for example, how sound wave technology is used to find diamond deposits and how some rocks emit fluorescence when observed under blue light. Students share their findings.  **A1.3, A1.4** **The Most Delicious Mine Activity** See the Resources column for this lesson plan.				