Atlantic Canada Science Curriculum

NOVA SCOTIA
Education
English Program Services

CURRICULUM

Science
Grade 3

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Atlantic Canada Science Curriculum:
Grade 3

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Foreword

The pan-Canadian *Common Framework of Science Learning Outcomes K to 12* (1997) provides the basis for the curriculum described in *Foundation for the Atlantic Canada Science Curriculum* (1998). The Atlantic Provinces Education Foundation (APEF) has developed new science curriculum guidelines for grades primary to 12.

Atlantic Canada Science Curriculum: Grade 3 includes the following units: life science, Earth and space science, and physical science.

This guide is intended to provide teachers with the outcomes framework for the course. It also includes some suggestions to assist teachers in designing learning experiences and assessment tasks.

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Introduction

Background

The curriculum described in *Foundation for the Atlantic Canada Science Curriculum* and related curriculum guides was planned and developed collaboratively by regional committees. The process for developing the common science curriculum for Atlantic Canada involved regional consultation with the stakeholders in the education system in each Atlantic province. The Atlantic Canada science curriculum is consistent with the framework described in the pan-Canadian *Common Framework of Science Learning Outcomes K to 12*.

Aim

The aim of science education in the Atlantic provinces is to develop scientific literacy.

Scientific literacy is an evolving combination of the science-related attitudes, skills, and knowledge that students need to develop inquiry, problem-solving, and decision-making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them. To develop scientific literacy, students require diverse learning experiences that provide opportunities to explore, analyse, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment.

Program Design and Components

Learning and Teaching Science

What students learn is fundamentally connected to how they learn it. The aim of scientific literacy for all has created a need for new forms of classroom organization, communication, and instructional strategies. The teacher is a facilitator of learning whose major tasks include

- creating a classroom environment to support the learning and teaching of science
- designing effective learning experiences that help students achieve designated outcomes
- stimulating and managing classroom discourse in support of student learning
- learning about and then using students' motivations, interests, abilities, and learning styles to improve learning and teaching
- assessing student learning, the scientific tasks and activities involved, and the learning environment to make ongoing instructional decisions
- selecting teaching strategies from a wide repertoire

Effective science learning and teaching take place in a variety of situations. Instructional settings and strategies should create an environment that reflects a constructive, active view of the learning process. Learning occurs through actively constructing one's own meaning and assimilating new information to develop a new understanding.

The development of scientific literacy in students is a function of the kinds of tasks in which they engage, the discourse in which they participate, and the settings in which these activities occur. Students' disposition towards science is also shaped by these factors. Consequently, the aim of developing scientific literacy requires careful attention to all of these facets of curriculum.

Learning experiences in science education should vary and should include opportunities for group and individual work, discussion among students as well as between teacher and students, and hands-on, minds-on activities that allow students to construct and evaluate explanations for the phenomena under investigation. Such investigations and the evaluation of the evidence accumulated provide opportunities for students to develop their understanding of the nature of science and the nature and status of scientific knowledge.

The Science Lesson—Links to the World

It is very important for children to learn through experiences in science. Students can engage in inquiry, problem solving, and decision making only through a hands-on, minds-on approach to learning. Using their senses, and the power of observation, and recording their findings—in writing, by illustration, or verbally—are key to a meaningful experience and understanding.

Before starting a science activity, the teacher should take the time to engage students in dialogue on their prior knowledge of a topic and to record key vocabulary words and thoughts to be used as a reference as the activity progresses. The teacher should also articulate and discuss expectations for communication and teamwork with the students before they engage in any hands-on, minds-on learning experiences that require them to be involved in groups.

During the lesson, the teacher should walk among the groups and listen, prompt discovery through questioning, and respond to the students' work. The teacher should act as a guide and support person to help students see themselves as capable and successful. This is an ideal opportunity to assess students' ability to meet the outcomes through the activity being done. Assessment can be in the form of notes, check-off lists, sticky notes, or thoughts to be written down at a later time. Recording assessment during an activity is sometimes a challenge, as the teacher is managing the class, as well as answering individual or group questions. Recording can be done during follow-up time or at a time more manageable for the teacher.

The follow-up to a lesson is crucial as it allows students the opportunity to communicate the ideas, discoveries, and questions that arise from engaging in a hands-on learning experience. Here the results of the activity are pulled together, and groups or individuals discuss with the whole class their findings from the activity. Additional vocabulary is often developed and should be recorded for future reference. Without follow-up to a lesson, an opportunity for students to achieve STSE knowledge, skills, and attitude outcomes can be missed. It is important to use this as a time for students to ask questions that might lead to exploration and investigation throughout the unit. Oftentimes the follow-up discussions will lead to further investigations to be done at another time.

Follow-up time can also be an ideal time to *link* other subject areas with science. This could include, for example, reflection on prior activities in math such as in measurement or data management, a shared or read-aloud experience related to the activity during language arts time, or an art activity. The science activity should not be an activity done for the sake of doing an activity. Discussion and links to other areas are key to students' continuing to view learning as an integrated whole.

Writing in Science

Learning experiences should provide opportunities for students to use writing and other forms of representation as ways of learning. Students, at all grade levels, should be encouraged to use writing to speculate, theorize, summarize, discover connections, describe processes, express understandings, raise questions, and make sense of new information using their own language as a step to the language of science. Science logs are useful for such expressive and reflective writing. Purposeful note making is an intrinsic part of learning in science, helping students to better record, organize, and understand information from a variety of sources. The process of creating word webs, maps, charts, tables, graphs, drawings, and diagrams to represent data and results helps students learn and also provides them with useful study tools.

Learning experiences in science should also provide abundant opportunities for students to communicate their findings and understandings to others, both formally and informally, using a variety of forms for a range of purposes and audiences. Such experiences should encourage students to use effective ways of recording and conveying information and ideas and to use the vocabulary of science in expressing their understandings. Through opportunities to talk and write about the concepts they need to learn, students come to better understand both the concepts and related vocabulary.

Learners will need explicit instruction in, and demonstration of, the strategies they need to develop and apply in reading, viewing, interpreting, and using a range of science texts for various purposes. It will be equally important for students to have demonstrations of the strategies they need to develop and apply in selecting, constructing, and using various forms for communicating in science.

The Three Processes of Scientific Literacy

An individual can be considered scientifically literate when he/she is familiar with, and able to engage in, three processes: inquiry, problem solving, and decision making.

Inquiry

Scientific inquiry involves posing questions and developing explanations for phenomena. While there is general agreement that there is no such thing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging in science. These activities provide students with opportunities to understand and practise the process of theory development in science and the nature of science.

Problem Solving

The process of problem solving involves seeking solutions to human problems. It consists of proposing, creating, and testing prototypes, products, and techniques to determine the best solution to a given problem.

Decision Making

The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are important in their own right, and they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

Meeting the Needs of All Learners

Foundation for the Atlantic Canada Science Curriculum stresses the need to design and implement a science curriculum that provides equitable opportunities for all students according to their abilities, needs, and interests. Teachers must be aware of, and make adaptations to accommodate, the diverse range of learners in their classes. To adapt instructional strategies, assessment practices, and learning resources to the needs of all learners, teachers must create opportunities that will permit them to address their various learning styles.

As well, teachers must not only remain aware of and avoid gender and cultural biases in their teaching, they must also actively address cultural and gender stereotyping (e.g., about who is interested in and who can succeed in science and mathematics). Research supports the position that when science curriculum is made personally meaningful and socially and culturally relevant, it is more engaging for groups traditionally under-represented in science and, indeed, for all students.

While this curriculum guide presents specific outcomes for each unit, it must be acknowledged that students will progress at different rates.

Teachers should provide materials and strategies that accommodate student diversity and should validate students when they achieve the outcomes to the best of their abilities.

It is important that teachers articulate high expectations for all students and ensure that all students have equitable opportunities to experience success as they work toward achieving designated outcomes. Teachers should adapt classroom organization, teaching strategies, assessment practices, time, and learning resources to address students' needs and build on their strengths. The variety of learning experiences described in this guide provides access for a wide range of learners. Similarly, the suggestions for a variety of assessment practices provide multiple ways for learners to demonstrate their achievements.

Assessment and Evaluation

The terms **assessment** and **evaluation** are often used interchangeably, but they refer to quite different processes. Science curriculum documents developed in the Atlantic region use these terms for the processes described below.

Assessment is the systematic process of gathering information on student learning.

Evaluation is the process of analysing, reflecting upon, and summarizing assessment information and making judgments or decisions based upon the information gathered.

The assessment process provides the data, and the evaluation process brings meaning to the data. Together, these processes improve teaching and learning. If we are to encourage enjoyment in learning for students now and throughout their lives, we must develop strategies to involve students in assessment and evaluation at all levels. When students are aware of the outcomes for which they are responsible and of the criteria by which their work will be assessed or evaluated, they can make informed decisions about the most effective ways to demonstrate their learning.

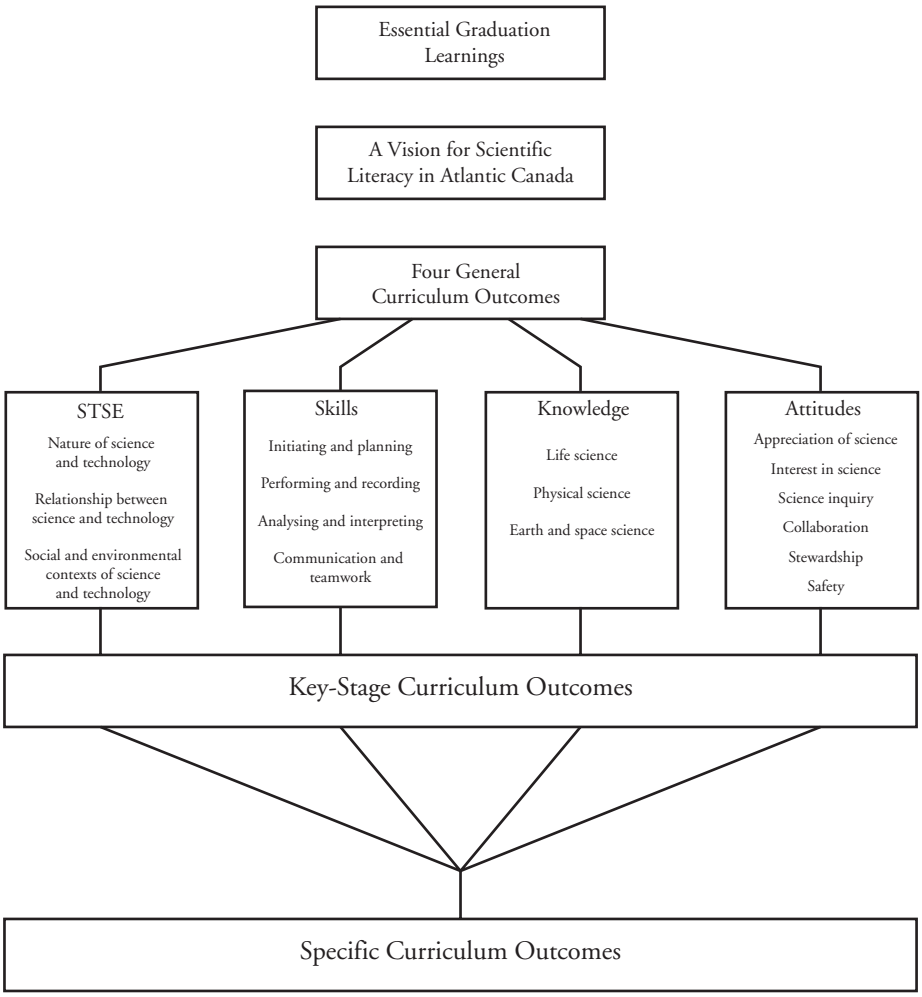
The Atlantic Canada science curriculum reflects the three major processes of science learning: inquiry, problem solving, and decision making. When assessing student progress, it is helpful to know some activities/skills/actions that are associated with each process of science learning. Student learning may be described in terms of ability to perform these tasks.

Curriculum Outcomes Framework

Overview

The science curriculum is based on an outcomes framework that includes statements of essential graduation learnings, general curriculum outcomes, key-stage curriculum outcomes, and specific curriculum outcomes. The general, key-stage, and specific curriculum outcomes reflect the pan-Canadian C*ommon Framework of Science Learning Outcomes K to 12*. The diagram below provides the blueprint of the outcomes framework.

Outcomes Framework



Essential Graduation Learnings

Essential graduation learnings are statements describing the knowledge, skills, and attitudes expected of all students who graduate from high school. Achievement of the essential graduation learnings will prepare students to continue to learn throughout their lives. These learnings describe expectations not in terms of individual school subjects but in terms of knowledge, skills, and attitudes developed throughout the curriculum. They confirm that students need to make connections and develop abilities across subject boundaries and to be ready to meet the shifting and ongoing opportunities, responsibilities, and demands of life after graduation. Provinces may add additional essential graduation learnings as appropriate. The essential graduation learnings are described below.

Aesthetic Expression

Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Citizenship

Graduates will be able to assess social, cultural, economic, and environmental interdependence in a local and global context.

Communication

Graduates will be able to use the listening, viewing, speaking, reading, and writing modes of language(s) as well as mathematical and scientific concepts and symbols to think, learn, and communicate effectively.

Personal Development

Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Problem Solving

Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language, mathematical, and scientific concepts.

Technological Competence

Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

General Curriculum Outcomes

The general curriculum outcomes form the basis of the outcomes framework. They also identify the key components of scientific literacy. Four general curriculum outcomes have been identified to delineate the four critical aspects of students' scientific literacy. They reflect the wholeness and interconnectedness of learning and should be considered interrelated and mutually supportive.

Science, Technology, Society, and the Environment (STSE)

Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

Skills

Students will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.

Knowledge

Students will construct knowledge and understandings of concepts in life science, physical science, and Earth and space science and will apply these understandings to interpret, integrate, and extend their knowledge.

Attitudes

Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment.

Key-Stage Curriculum Outcomes

Key-stage curriculum outcomes are statements that identify what students are expected to know, be able to do, and value by the end of grades 3, 6, 9, and 12 as a result of their cumulative learning experiences in science. The key-stage curriculum outcomes are from the *Common Framework of Science Learning Outcomes K to12*.

Specific Curriculum Outcomes

This curriculum guide outlines specific curriculum outcomes for grade 3 science and provides suggestions for learning, teaching, assessment, and resources to support students' achievement of these outcomes. Teachers should consult *Foundation for the Atlantic Canada Science Curriculum* for descriptions of the essential graduation learnings, vision for scientific literacy, general curriculum outcomes, and key-stage curriculum outcomes.

Specific curriculum outcome statements describe what students are expected to know and be able to do at each grade level. They are intended to help teachers design learning experiences and assessment tasks. Specific curriculum outcomes represent a framework for assisting students to achieve the key-stage curriculum outcomes, the general curriculum outcomes, and ultimately the essential graduation learnings.

Specific curriculum outcomes are organized in four units. Each unit is organized by topic. Grade 3 science units and topics follow.

Life Science: Plant Growth and Changes

- Investigating Germination and Growing Conditions for Plants
- The Life Cycle of a Plant
- Uses for Plants

Earth and Space Science: Exploring Soils

- Investigating Soils Composition
- Water Absorption of Soils
- Moving Water and Soil
- Interactions of Living Things and Soil
- Technological Products and Processes Related to Soil

Physical Science: Invisible Forces

- Magnetic Forces
- Electrostatic Forces (Forces Arising from Static Electricity)

Physical Science: Materials and Structures

- Proposing Solutions to Building Challenges
- Creating Solutions to Structural Challenges
- Evaluating the Structural Solution

The following pages outline specific curriculum outcomes for grade 3 science, grouped by units and topics.

Life Science: Plant Growth and Changes

Students will be expected to

Investigating Germination and Growing Conditions for Plants

- place seeds in groups according to one or more attributes (202-2)
- question and record relevant observations and measurements while investigating various growing conditions for plants (200-1, 201-5, 202-4)
- identify and describe parts of plants and their general function (100-28)
- identify, investigate, and suggest explanations for life needs of plants and describe how plants are affected by conditions in which they grow (100-29)

The Life Cycle of a Plant

- observe, describe, and measure, using written language, pictures, and charts, changes that occur through the life cycle of a flowering plant (201-3, 203-3, 202-4)
- observe and describe changes that occur through the life cycle of a flowering plant (100-30)

Uses for Plants

- describe and respond to ways in which plants are important to living things and the environment and how the supply of useful plants is replenished (102-12, 102-13, 203-5)

Earth and Space Science: Exploring Soils

Students will be expected to

Investigating Soils Composition

- ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- investigate, describe, and record a variety of soils and their components using words and diagrams (100-36, 100-37, 201-3, 201-5)

Water Absorption of Soils

- describe, predict, and compare the absorption of water by different types of soil (100-38, 200-3)
- communicate procedures and results of investigations related to water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions (203-3)

Moving Water and Soil

- observe and describe the effects of moving water on different types of soil (100-39)

Interactions of Living Things and Soil

- investigate and describe how living things affect and are affected by soils (100-35)

Technological Products and Processes Related to Soil

- demonstrate and describe earth materials while exploring objects made from them (101-12, 203-1)

Physical Science: Invisible Forces

Students will be expected to

Magnetic Forces

- investigate to identify and group materials that can be magnetized or attracted by magnets and distinguish these from materials that are not attracted to magnets (100-31, 202-2)
- investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel (100-32)
- identify familiar uses of magnets (102-14)
- follow procedures and identify problems related to strength of temporary magnets and to magnetizing materials (200-2, 201-1)
- make predictions, record observations, and identify proposed questions about the number of objects that can be picked up by a magnet under different conditions (200-3, 201-5)
- construct and evaluate a toy that is moved by magnetic forces (201-3, 202-8)

Electrostatic Forces (Forces Arising from Static Electricity)

- demonstrate and describe ways to use everyday materials to produce static electric charges and describe how charged materials interact (101-8)
- identify and investigate conditions that affect the force of magnets and of static electric materials (100-33, 202-7)
- identify questions and describe examples of the effects of static electricity in their daily lives and ways in which it can be used safely or avoided (102-15)

Physical Science: Materials and Structures

Students will be expected to

Proposing Solutions to Building Challenges

- identify problems to be solved while creating structures (200-2)
- describe, evaluate, and investigate common materials, their suitability for use in building structures, and ways to join materials together (100-34, 101-11)
- identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance (102-16)
- identify materials that could be used to solve the problem posed and suggest a plan for how they will be used through oral, written, and/or illustrated responses (200-5, 203-3)

Creating Solutions to Structural Challenges

- safely use and follow safety procedures while using appropriate tools and materials to construct structures (101-10, 201-3, 201-8)
- manipulate materials and respond to the ideas of others to make changes in creating structures as deemed necessary (201-2, 203-5)

Evaluating the Structural Solution

- test the strength and stability of a personally built structure, identify ways to increase its strength, stability, form, and structure, and identify parts of the structure that failed (202-8, 101-9)
- evaluate simple structures to determine if they are effective and safe, if they make efficient use of materials, and if they are appropriate to the user and the environment (102-17)

Attitudes Outcomes

It is expected that the Atlantic Canada science program will foster certain attitudes in students throughout their school years. The STSE, skills, and knowledge outcomes contribute to the development of attitudes; and opportunities for fostering these attitudes are highlighted in the Elaborations—Strategies for Learning and Teaching sections of each unit.

Attitudes refer to generalized aspects of behaviour that teachers model for students by example and by selective approval. Attitudes are not acquired in the same way as skills and knowledge. The development of positive attitudes plays an important role in students' growth by interacting with their intellectual development and by creating readiness for responsible application of what students learn.

Since attitudes are not acquired in the same way as skills and knowledge, outcome statements for attitudes are written as key-stage curriculum outcomes for the end of grades 3, 6, 9, and 12. These outcome statements are meant to guide teachers in creating a learning environment that fosters positive attitudes.

The following pages present the attitude outcomes from the pan-Canadian *Common Framework of Science Learning Outcomes K to 12* for the end of grade 3.

Key-Stage Curriculum Outcomes: Attitudes

By the end of grade 3, students will be expected to

Appreciation of Science	Interest in Science	Scientific Inquiry
400 recognize the role and contribution of science in their understanding of the world *Evident when students, for example,* • give examples of science in their own lives • give examples of how objects studied and investigations done in class relate to the outside world • recognize that scientific ideas help us to explain how or why events occur	**401** show interest in and curiosity about objects and events within the immediate environment **402** willingly observe, question, and explore *Evident when students, for example,* • ask "what happens if ..." and "how" questions about observable events • ask many questions related to what is being studied • participate in show-and-tell activities, bringing objects from home or sharing a story or an observation • ask questions about what scientists do • express enjoyment from being read to from science books • seek out additional information from library books and digital discs • express enjoyment in sharing science-related information gathered from a variety of sources, including discussions with family members and friends • ask to use additional science equipment to observe objects in more detail • express the desire to find answers by exploring and conducting simple experiments	**403** consider their observations and their own ideas when drawing a conclusion **404** appreciate the importance of accuracy **405** be open-minded in their explorations *Evident when students, for example,* • raise questions about the world around them • willingly record observations in a given format • compare results of an experiment with other classmates • use observations to draw a conclusion or verify a prediction • take the time to measure with care • willingly explore a change and its effects • choose to follow directions when they complete a simple investigation • express the desire to find answers by conducting simple experiments

Key-Stage Curriculum Outcomes: Attitudes

By the end of grade 3, students will be expected to

Collaboration	Stewardship	Safety
406 work with others in exploring and investigating *Evident when students, for example,* • willingly share ideas and materials • respond positively to others' questions and ideas • take on and fulfil a variety of roles within the group • participate in science-related activities with others, regardless of their age or their physical or cultural characteristics • respond positively to other people's views of the world	**407** be sensitive to the needs of other people, other living things, and the local environment *Evident when students, for example,* • ensure that living things are returned to an adequate environment after a study is completed • demonstrate awareness of the need for recycling and willingness to take action in this regard • show concern for other students' feelings or needs • care for living things that are kept in their classroom • clean reusable materials and store them in a safe place • willingly suggest how we can protect the environment	**408** show concern for their safety and that of others in carrying out activities and using materials *Evident when students, for example*, • are attentive to the safe use of materials • insist that classmates use materials safely • act with caution in touching or smelling unfamiliar materials, refrain from tasting them, and encourage others to be cautious • point out to others simple and familiar safety symbols • put materials back where they belong • follow given directions for set-up, use, and clean-up of materials • wash hands before and after using materials, as directed by the teacher • seek assistance immediately for any first-aid concerns like cuts, burns, and unusual reactions • keep the workstation uncluttered, with only appropriate materials present

Curriculum Guide Organization

Specific curriculum outcomes are organized into units for each grade level. Each unit is organized by topic. Suggestions for learning, teaching, assessment, and resources are provided to support student achievement of the outcomes.

The order in which the units of a grade appear in the guide is meant to suggest a sequence. In some cases, the rationale for the recommended sequence is related to the conceptual flow across the year. That is, one unit may introduce a concept that is then extended in a subsequent unit. Likewise, one unit may focus on a skill or context that will be built upon later in the year.

Some units or certain aspects of units may also be combined or integrated. This is one way of assisting students as they attempt to make connections across topics in science or between science and the real world. In some cases, a unit may require an extended time frame to collect data on weather patterns, plant growth, and so on. These cases may warrant starting the activity early and overlapping it with the existing unit. In all cases, the intent is to provide opportunities for students to deal with science concepts and scientific issues in personally meaningful and socially and culturally relevant contexts.

Unit Organization

Each unit begins with a two-page synopsis. On the first page, introductory paragraphs provide a unit overview. These are followed by a section that specifies the focus (inquiry, problem solving, and/or decision making) and possible contexts for the unit. Finally, a curriculum links paragraph specifies how this unit relates to science concepts and skills addressed in other grades so teachers will understand how the unit fits with the students' progress through the complete science program.

The second page of the two-page overview provides a table of the outcomes from the *Common Framework of Science Learning Outcomes K to 12* that the unit will address. The numbering system used is the one in the pan-Canadian document as follows:

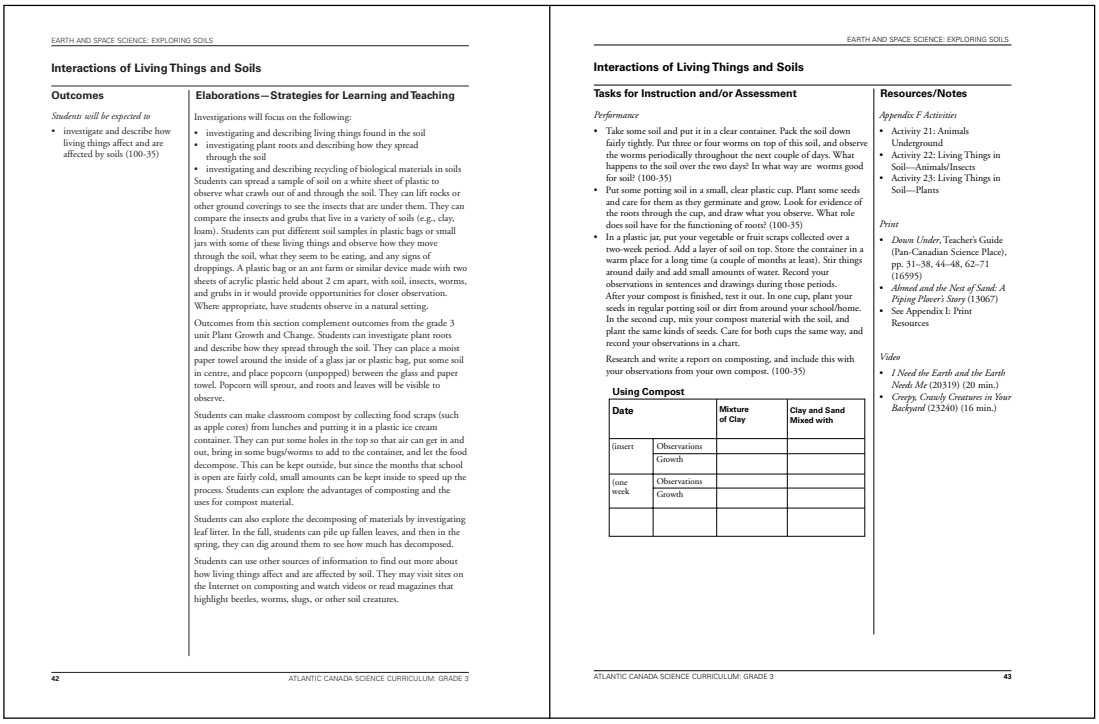
- 100s—Science-Technology-Society-Environment (STSE) outcomes
- 200s—Skills outcomes
- 300s—Knowledge outcomes
- 400s—Attitude outcomes (see pages 16–18)

These code numbers appear in parentheses after each specific curriculum outcome (SCO).

The Four-Column Spread

All units have a two-page layout of four columns as illustrated below. In some cases, the four-column spread continues to the next two-page layout. Outcomes are grouped by a topic indicated at the top of the left-hand page.

Two-Page, Four-Column Spread



EARTH AND SPACE SCIENCE: EXPLORING SOILS

Interactions of Living Things and Soils

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to • investigate and describe how living things affect and are affected by soils (100-35)	Investigations will focus on the following: • investigating and describing living things found in the soil • investigating plant roots and describing how they spread through the soil • investigating and describing recycling of biological materials in soils Students can spread a sample of soil on a white sheet of plastic to observe what crawls out of and through the soil. They can lift rocks or other ground coverings to see the insects that are under them. They can compare the insects and grubs that live in a variety of soils (e.g., clay, loam). Students can put different soil samples in plastic bags or small jars with some of these living things and observe how they move through the soil, what they seem to be eating, and any signs of droppings. A plastic bag or an ant farm or similar device made with two sheets of acrylic plastic held about 2 cm apart, with soil, insects, worms, and grubs in it would provide opportunities for closer observation. Where appropriate, have students observe in a natural setting. Outcomes from this section complement outcomes from the grade 3 unit Plant Growth and Change. Students can investigate plant roots and describe how they spread through the soil. They can place a moist paper towel around the inside of a glass jar or plastic bag, put some soil in centre, and place popcorn (unpopped) between the glass and paper towel. Popcorn will sprout, and roots and leaves will be visible to observe. Students can make classroom compost by collecting food scraps (such as apple cores) from lunches and putting it in a plastic ice cream container. They can put some holes in the top so that air can get in and out, bring in some bugs/worms to add to the container, and let the food decompose. This can be kept outside, but since the months that school is open are fairly cold, small amounts can be kept inside to speed up the process. Students can explore the advantages of composting and the uses for compost material. Students can also explore the decomposing of materials by investigating leaf litter. In the fall, students can pile up fallen leaves, and then in the spring, they can dig around them to see how much has decomposed. Students can use other sources of information to find out more about how living things affect and are affected by soil. They may visit sites on the Internet on composting and watch videos or read magazines that highlight beetles, worms, slugs, or other soil creatures.

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EARTH AND SPACE SCIENCE: EXPLORING SOILS

Interactions of Living Things and Soils

Tasks for Instruction and/or Assessment	Resources/Notes
Performance • Take some soil and put it in a clear container. Pack the soil down fairly tightly. Put three or four worms on top of this soil, and observe the worms periodically throughout the next couple of days. What happens to the soil over the two days? In what way are worms good for soil? (100-35) • Put some potting soil in a small, clear plastic cup. Plant some seeds and care for them as they germinate and grow. Look for evidence of the roots through the cup, and draw what you observe. What role does soil have for the functioning of roots? (100-35) • In a plastic jar, put your vegetable or fruit scraps collected over a two-week period. Add a layer of soil on top. Store the container in a warm place for a long time (a couple of months at least). Stir things around daily and add small amounts of water. Record your observations in sentences and drawings during those periods. After your compost is finished, test it out. In one cup, plant your seeds in regular potting soil or dirt from around your school/home. In the second cup, mix your compost material with the soil, and plant the same kinds of seeds. Care for both cups the same way, and record your observations in a chart. Research and write a report on composting, and include this with your observations from your own compost. (100-35) **Using Compost**	*Appendix F Activities* • Activity 21: Animals Underground • Activity 22: Living Things in Soil—Animals/Insects • Activity 23: Living Things in Soil—Plants *Print* • *Down Under*, Teacher's Guide (Pan-Canadian Science Place), pp. 31–38, 44–48, 62–71 (16595) • *Ahmed and the Nest of Sand: A Piping Plover's Story* (13067) • See Appendix I: Print Resources *Video* • *I Need the Earth and the Earth Needs Me* (20310) (20 min.) • *Creepy, Crawly Creatures in Your Backyard* (23240) (16 min.)

Date		Mixture of Clay	Clay and Sand Mixed with
(insert	Observations		
	Growth		
(one week	Observations		
	Growth		

ATLANTIC CANADA SCIENCE CURRICULUM: GRADE 3 43

Column One: Outcomes

The first column provides the specific curriculum outcomes. These are based on the pan-Canadian *Common Framework of Science Learning Outcomes K to 12*. The statements involve the Science-Technology-Society-Environment (STSE), skills, and knowledge outcomes indicated by the outcome number(s) that appears in parentheses after the outcome. Some STSE and skills outcomes have been written in a context that shows how these outcomes should be addressed.

Specific curriculum outcomes have been grouped by topic. Other groupings of outcomes are possible and in some cases may be necessary to take advantage of local situations. The grouping of outcomes provides a suggested teaching sequence. Teachers may prefer to plan their own teaching sequences to meet the learning needs of their students.

In grade 3, the STSE and knowledge outcomes are combined.

Column one and column two define what students are expected to learn and be able to do.

Column Two: Elaborations—Strategies for Learning and Teaching

The second column may include elaborations of outcomes listed in column one and describes learning environments and experiences that will support students' learning.

The strategies in this column are intended to provide a holistic approach to instruction. In some cases, they address a single outcome; in other cases, they address a group of outcomes.

Column Three: Tasks for Instruction and/or Assessment

The third column provides suggestions for ways in which students' achievement of the outcomes could be assessed. These suggestions reflect a variety of assessment techniques and materials that include, but are not limited to, informal/formal observation, performance, journal, interview, paper and pencil, presentation, and portfolio. Some assessment tasks may be used to assess student learning in relation to a single outcome, others to assess student learning in relation to several outcomes. The assessment item identifies the outcome(s) addressed by the outcome number in parentheses after the item.

Column Four: Resources/Notes

This column includes activities to support student achievement in meeting specific curriculum outcomes found in Appendices E–H of this guide; *Pan-Canadian Science Place*, teacher's guide; print resources available through the Nova Scotia School Book Bureau (order numbers are listed beside titles); videos available through Education Media Library, Learning Resources and Technology (call numbers listed beside title); as well as links to other curriculum areas, where applicable. This column also provides an opportunity for teachers to make notes about other useful resources.

Life Science: Plant Growth and Changes

Introduction

Careful observation of the natural world reveals patterns of growth—how plants grow and respond to their natural environment. Students' awareness of plants begins with a variety of informal encounters within the local environment, but their deeper understanding grows best from experience in planting, nurturing, and observing individual plants over an extended period of time.

Focus and Context

This unit starts off with an inquiry focus, as students investigate how various conditions affect plant growth and explore the life cycles of plants. The unit then proceeds to introduce technological products and processes that use plants to meet the needs of people.

Science Curriculum Links

Students have already explored the needs and characteristics of plants in grade 1. This unit on plant growth will complement and reinforce outcomes in the Soils unit that is also done in grade 3. They should then have the background necessary for the grade 4 unit Habitats and Communities, in which they explore features of plants that enable them to thrive in different places.

Curriculum Outcomes

The following outcomes have been developed from *Common Framework of Science Learning Outcomes, K to 12* pan-Canadian outcomes. See Appendix J for the original outcomes that these were derived from.

STSE/Knowledge	Skills
Students will be expected to	*Students will be expected to*
100-28 identify and describe parts of plants and their general function	**202-2** place seeds in groups according to one or more attributes
100-29 identify, investigate, and suggest explanations for life needs of plants and describe how plants are affected by conditions in which they grow	**200-1, 201-5, 202-4** question and record relevant observations and measurements while investigating various growing conditions for plants
100-30 observe and describe changes that occur through the life cycle of a flowering plant	**201-3, 203-3, 202-4** observe, describe, and measure, using written language, pictures, charts, and graphs changes that occur through the life cycle of a flowering plant
102-12, 102-13, 203-5 describe and respond to ways in which plants are important to living things and the environment and how the supply of useful plants is replenished	

Investigating Germination and Growing Conditions for Plants

Outcomes

Students will be expected to

- place seeds in groups according to one or more attributes (202-2)
- question and record relevant observations and measurements while investigating various growing conditions for plants (200-1, 201-5, 202-4)

Elaborations—Strategies for Learning and Teaching

Plant Growth and Changes is an excellent unit that can be done throughout the year. Read ahead to the next unit, Exploring Soils. It has outcomes related to soil factors and their effects on living things. Start planting now in preparation for those activities.

Students can bring in a variety of seeds to use in their investigations. In order to address outcomes later in this unit related to the usefulness of plants, the teacher should supply herb or vegetable seeds.

⚠ **Caution: Do not use commercial seeds that have been treated with powder fungicide.**

Initially, students can compare the different kinds of seeds, noting their size, shape, colour, thickness, and appearance. Students can decide on some common attributes of the seeds and group them accordingly, using a property chart.

⚠ **Caution: Allergy Alert! Teachers should be aware of any nut allergies if nuts are to be used.**

Let students share their knowledge of the needs of plants. Students should generate questions that they might wish to investigate related to possible conditions to germinate and grow their plants. Students will probably know that plants need to be watered, but how much? How often? Examples of questions students might ask are: "Will watering the plant make it grow better if watered once or twice a week?" "Will this plant grow better in the sunlight or darkness?" They can then make predictions about which conditions they feel will produce the best-growing plants and record them in their journal or science log.

⚠ **Caution: Chemical Alert! Students should not use any herbicides, pesticides, or other harmful chemicals as part of their tests.**

Students should plant their seeds, being careful to record on their pot or cup, so that plants do not get mixed up. Students need to record their plant's condition in their science log (private science). Students should accurately record their observations and measurements of the plant's growth. This activity provides an excellent opportunity to develop the concept of a fair test (only one thing is tested at a time). Some conditions to try include varying the amount of water or light, temperature, wind, type of soil, and the inclusion of weeds.

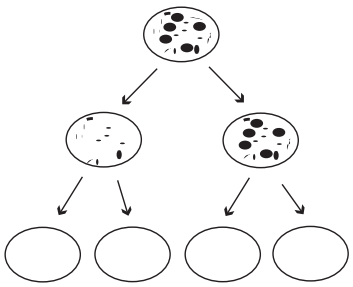
Students should construct a bar graph once all the data is collected. This can be used to reinforce their math graphing skills. Technology, such as spreadsheet and commercial software, can be used to generate the graph.

Investigating Germination and Growing Conditions for Plants

Tasks for Instruction and/or Assessment

Performance

- From all of the seeds you have been given, decide on a way to group them. Use a dichotamous key as shown. State your rule for sorting. (202-2)



- Fill in the chart Helping Plants Grow as you test various conditions for growing plants. When you are finished, construct a bar chart to show the plant's growth. From the list, students have generated, various groups can select the variables they wish to investigate. Results can be shared with the class. Each of the variables should have a separate column in the chart. (200-1, 201-5, 202-4)

Helping Plants Grow

Date	Conditions affecting plant growth	Observations and drawings (include height of plant)

Journal

- I would like to find out if ... can make my plant grow faster. I predict that ... (200-1, 201-5, 202-4)

Interview

- What are some of the factors that might affect the growth of plants? Groups might graph different variables such as the amount of water, the amount of light, and soil type and depth. (200-1, 201-5, 202-4)

Resources/Notes

Appendix E Activities

- Activity 1: Seeds
- Activity 2: Conditions for Plant Growth
- Activity 3: How Well Is Your Plant Growing?

Print

- *Watch It Grow*, Teacher's Guide (Pan-Canadian Science Place), pp. 22–26, 33–36, 37–41, 81–88 (16592)
- *Be a Plant Scientist* (Big Book) (13352)
- See Appendix I: Print Resources

Videos

- *Sunflowers* (21661) (10 min.)
- *What Makes a Plant a Plant?* (23337) (15 min.)
- *Where Do Plants Come From?* (23336) (15 min.)
- *Wonders of Growing Plants* (21490) (14 min.)

Curriculum Links

- See Math: GCO D

Investigating Germination and Growing Conditions for Plants *(continued)*

Outcomes

Students will be expected to

- identify and describe parts of plants and their general function (100-28)
- identify, investigate, and suggest explanations for life needs of plants and describe how plants are affected by conditions in which they grow (100-29)

Elaborations—Strategies for Learning and Teaching

Students need to investigate the conditions required for plant growth (light, water, food, space) through a variety of hands-on learning experiences. They should describe the results and draw pictures to illustrate their plants. Based on their observations, students should make inferences about the needs of plants. Based on an experiment growing plants in different amounts of light, student can infer that light affects how plants grow. Students can investigate how these conditions would affect other plants, for example, cactus, aquatic plant, epiphyte, or hydroponically grown plant.

While the students' plants are growing in the classroom, they can take walks outside and compare plants in their local environment. They can note which kinds of plants grow on hills, under trees, in rocky areas, or by the seashore. Students may observe plants of the same kind growing in different locations and note any differences. Students should suggest explanations for any observed patterns. Before the field trip, students should develop an observation sheet to record their findings.

Students should be encouraged to use appropriate terminology for the parts of the plants (limit to roots, stem, seed, flower, trunk, bark, leaves). This should be recorded in their science logs. The functions of various parts can be explored through classroom discussion, observation, drawing from the results of their investigations, and print and electronic resources. Students can draw, label, and name a variety of local plants.

Investigating Germination and Growing Conditions for Plants *(continued)*

Tasks for Instruction and/or Assessment

Journal

- Choose a plant. Label its parts and write a description of the conditions it needs for growth. (100-28, 100-29)

Interview

- Can you think of conditions that affect the growth of plants? (Teacher can name type of plant students have obeserved in class, a local plant, fruit, or vegetable.) (100-29)
- What is the function of a plant's roots? (Teachers can question about other plant parts throughout this unit.) (100-28)

Paper and Pencil

- Draw pictures of the plants in your class that grew under different conditions. Which plants grew best? How do you know? (100-29)

Resources/Notes

Appendix E Activities

- Activity 4: Parts of a Plant
- Activity 5: Parts of a Plant—The Seed
- Activity 6: Light and Plants

Print

- *Watch It Grow*, Teacher's Guide (Pan-Canadian Science Place), pp. 12–36, 42–47, 81–88 (16592)
- *How to Grow a Sunflower* (big book) (13346)
- See Appendix I: Print Resources

Video

- *Plants: A First Look* (23315) (17 min.)

Curriculum Links

- See Health Education: SCO C4.1

The Life Cycle of a Plant

Outcomes

Students will be expected to

- observe, describe, and measure, using written language, pictures, charts, and graphs changes that occur through the life cycle of a flowering plant (201-3, 203-3, 202-4)
- observe and describe changes that occur through the life cycle of a flowering plant (100-30)

Elaborations—Strategies for Learning and Teaching

Students should grow flowering plants or have an opportunity to observe flowering plants over a long period of time (such as marigolds, bulbs). Students can plant seeds in a container that will allow a view of the seed as it germinates. Consider using a paper towel-lined glass jar with soil in centre or a plastic bag taped to the window. As the seed germinates, the students can unfold the paper towel to track the seed's progress. Students can use drawings to record their observations of the plant's life cycle, estimate the length of various parts of the plant (for example, leaf size, root length, height), and take measurements. Students can record their measurements in charts and graphs. Students can observe the bloom using a magnifying glass or Intel Microscope. The whole sequence of plant growth (germination, sprouting, buds forming, flowering, pollination, fruit/seed growth) can be observed. The newly formed seeds can then be potted to continue their cycle back to seeds. Students may explore other ways to grow plants (from clippings, bulbs, or the eye of a potato).

Students can investigate through hands-on experiences and video, print, and electronic sources how pollen and seeds are carried from place to place. Wind, rain, birds, insects, and other means of transporting seeds can be noted. Students may recall how dandelions turn white and puffy as their life cycle continues, and how the seeds are then spread by the wind.

Teacher Note: *It is important to provide many opportunities to explore measurement outcomes during math time early in the year and as the year continues.*

Stages of flowering plants are also depicted in works of art. Use any opportunity to view the natural world of plants through the eyes of the artist as a connection to visual arts.

The Life Cycle of a Plant

Tasks for Instruction and/or Assessment

Performance

- Draw pictures that show the different stages (germination, sprouting, buds forming, flowering, pollination, fruit/seed growth) of a flowering plant you are growing. (100-30)
- Draw, cut out, or create pictures of the stages in the life cycle of a flowering tree and put them in order. (Include a picture of seeds, the seed germinating, the flower buds starting to form, the flowering stage, and the seeds forming (100-30)

Presentation

- Perform a skit or produce a video on the life cycle of a flowering plant. (100-30)

Pencil and Paper

- Using your plant data, construct an appropriate graph. Include a chart and a diagram. (201-3, 203-3, 202-4)

Resources/Notes

Appendix E Activities

- Activity 7: A Flowering Plant
- Activity 8: Stages of a Flowering Plant

Print

- *Watch It Grow*, Teacher's Guide (Pan-Canadian Science Place), pp. 12–16, 37–52 (16592)
- *Lifecycles* (big book) (13751)

Videos

- *Flowering Plants: From Seed to Seed* (21932) (11 min.)
- *Growing* (V2369) (15 min.)
- *Seeds in Motion* (23035) (15 min.)

Uses for Plants

Outcomes

Students will be expected to

- describe and respond to ways in which plants are important to living things and the environment and how the supply of useful plants is replenished (102-12, 102-13, 203-5)

Elaborations—Strategies for Learning and Teaching

Are students aware of the importance of plants to living things? Shelter, food, and oxygen will be common. Students can be introduced to products and processes derived from plants that have been developed to meet the needs of humans. Students, in groups or individually, can explore a use for plants and present their findings to the class. Through inquiry then research, students can explain a variety of uses for plants. This activity reinforces social studies outcomes on sustainability. Students can focus on the following:

- **Food**: The leaves of some plants can be eaten (for example, dandelion, beet, lettuce) or used for flavouring (for example, mint, tea, savoury). The roots of some plants (for example, turnip, carrots, beets), some flowers (for example, nasturtiums), and many seeds (for example, sunflower, poppy) are edible. Students can grow small vegetables like carrots or peas, collect dandelions, or bring in a variety of edible seeds, roots, and fruits and have a vegetarian feast day.

Caution: Students should be warned that not all plants are edible.

- **Art and decoration**: Students can collect local wildflowers, and practise arranging them, drying them, and making a variety of craft items using them.
- **Medicines** (for example, garlic, ginseng): Students can interview people in their community to find out natural remedies using specific plants and make a poster or collage to illustrate their findings.
- **Dyes** (for example, beet [red], blueberries [blue], onions [yellow]): Students can tie-dye white T-shirts using the dyes from local plants.
- **Fibres** (for example, cotton, straw used in baskets, cellulose or tree fibres used in making paper, onion skins are used for paper): Students can make paper, do some basket weaving, or bring in clothes made from cotton.

Uses for Plants

Tasks for Instruction and/or Assessment

Interview

- Describe ways in which plants are important to humans and all living organisms. (102-12, 102-13, 203-5)

Paper and Pencil

- Classify food items according to the plant part used. (102-12, 102-13, 203-5)

How We Use Plants

Bark	Sap	Seed/ Flower	Roots	Stem/ Trunk	Leaves
cinnamon	maple (maple syrup)	apples	carrots	celery	lettuce

Presentation

- Create a video, scene, or pictorial presentation on how plants are important for survival in a natural environment. (This could include water or land.) (102-12, 102-13, 203-5)
- Create a video, dramatic, or pictorial representation on human uses of plants. (102-12, 102-13, 203-5)

Resources/Notes

Appendix E Activities

- Activity 9: Uses of Plants
- Activity 10: Uses of Plants—A Nature Walk
- Activity 11: The Artful Seed

Print

- *Watch It Grow*, Teacher's Guide (Pan-Canadian Science Place), pp. 53–79 (16592)
- *Food Alphabet* (big book) (13350)
- *Food around the World* (Factivity Series) (13776)
- *What Do I Eat?* (big book) (13342)
- See Appendix I: Print Resources

Video

- *Plants and Their Importance* (23326) (15 min.)

Curriculum Links

- See Health Education: C4.2

Uses for Plants *(continued)*

Outcomes

Students will be expected to

- describe and respond to ways in which plants are important to living things and the environment and how the supply of useful plants is replenished (102-12, 102-13, 203-5)

Elaborations—Strategies for Learning and Teaching

- **Providing oxygen**: Animals need oxygen to breathe. Plants produce oxygen and also can filter impurities from the air. Students can plant trees around the school yard as a naturalization project.
- **Preventing erosion** (e.g., cross-slope plowing in farming): Look in the grade 3 Exploring Soils unit for activities related to this use.
- **Building materials**: Students can look at the wide variety of wood products that are made from the trunks of trees (e.g., plywood, lumber, panelling). If possible, students can visit a local sawmill to see how trees are processed into lumber.

Students should explore issues on the uses and replenishing of plants using a role-play dramatization where they will formulate the ideas and propose solutions to various environmental issues.

Guest speakers or field trips provide excellent opportunities to experience, first-hand or from the experts, the uses, manufacturing techniques, and environmental concerns related to plant growth and replenishment. Students should understand that some plants, such as lady slippers, are endangered and are not to be disturbed. Depending on the locality, students could visit

- the produce section of the grocery store
- farm
- florist
- logging camp
- seashore
- company employing silvaculture techniques
- paper mill
- a factory that processes fruit, vegetables, flowers, or trees
- recycling plant

Students can interview

- fishers
- farmers
- gardeners
- environmentalists
- grocers
- loggers

Uses for Plants *(continued)*

Tasks for Instruction and/or Assessment

Journal

- Today we visited (or had a visitor from) a _____ (farm, garden centre, paper mill, green house, or industrial processor of plant products). I learned that ... The best part of the trip (or talk/ demonstration) was ... (102-12, 102-13, 203-5)

Interview

- What can you do to replenish plants in our environment? How does the natural world benefit from this action? (102-12, 102-13, 203-5)

Presentation

- Develop a presentation about being a user of plants that illustrates the importance of replenishing plants. (102-12, 102-13, 203-5)

Resources/Notes

Appendix E Activities

- Activity 9: Uses of Plants
- Activity 10: Uses of Plants—A Nature Walk
- Activity 11: The Artful Seed

Print

- *Watch It Grow*, Teacher's Guide (Pan-Canadian Science Place), pp. 58–70, 75–80 (16592)
- *Amazing Animals* (big book) (13341)
- *This Is Our World* (big book) (13791)
- See Appendix I: Print Resources

Earth and Space Science: Exploring Soils

Introduction

Students discover that soil is an environment for many living things. It is a place for creatures to live in and for plants to grow in; it provides a base for gardens, forests, fields, and farms. By examining soils, students discover that soils are made up of more than one type of substance and that the particular combination of materials in soil has a lot to do with what lives in it and on it. By focussing on the ways in which we can change soil—especially changes that occur as a result of water—students learn that soil is affected by humans and the environment.

Focus and Context

Inquiry activities are the focus of this unit. Students should have many opportunities to observe, manipulate, and test various soil samples to explore their composition, water absorption, drainage, and how they erode. The importance of soils to living things, and how technological processes transform soil into other products is emphasized.

Science Curriculum Links

This unit should complement the grade 3 unit, Plant Growth and Changes, since many of the activities can be used to address outcomes from both units.

Exploring Soils will provide the background knowledge necessary for a grade 4 unit, Rocks, Minerals, and Erosion.

Curriculum Outcomes

The following outcomes have been developed from *Common Framework of Science Learning Outcomes, K to 12* pan-Canadian outcomes. See Appendix J for the original outcomes that these were derived from.

STSE/Knowledge	Skills
Students will be expected to	*Students will be expected to*
100-39 observe and describe the effects of moving water on different types of soil	**100-38, 200-3** describe, predict, and compare the absorption of water by different types of soil
101-12, 203-1 demonstrate and describe earth materials while exploring objects made from them	**100-35** investigate and describe how living things affect and are affected by soils
100-36, 100-37, 201-3, 201-5 investigate, describe, and record a variety of soils and their components using words and diagrams	**200-1, 200-3** ask questions and make predictions that lead to exploration and investigation about the composition of soil
	203-3 communicate procedures and results of investigations related to water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions

Investigating Soils Composition

Outcomes

Students will be expected to

- ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- investigate, describe, and record a variety of soils and their components using words and diagrams (100-36, 100-37, 201-3, 201-5)

Elaborations—Strategies for Learning and Teaching

This unit should be integrated with the unit Plant Growth and Changes. As students determine the factors that affect the growth of plants, they should investigate soil type. Teachers should have students fill out a chart with the column headings What I Know about Soil and Questions I Have about What I Know. Some of things that they might know could be that soil has worms in it, soil helps plants grow, or soil has rocks in it. Some of things they might want to learn about could be, Is soil the same everywhere? What kind of soil is best for growing plants? How is soil made? Some of these questions will be investigated during this unit. Inquiry on soil composition will be the focus of this section.

In this section, students explore a variety of types of soil samples from different areas, for example, river bank, forest, grassy field, top of a hill, bottom of a hill, to determine how the composition of soil varies. If students bring in soil samples from their backyards, they probably will get a totally different soil composition than from more natural settings, since many homes are built on fill that has been trucked in and not on the original soil.

Caution: It is advisable to wear gloves when working with soil.

Students can spread out the soil samples on newspapers and note similarities and differences in properties such as colour, texture, and ability to hold together. Magnifying glasses can be used to further explore these soils.

Students can separate and view the components of various soil samples by putting them in a clear plastic jars, adding water, and shaking them. The jars should be left to settle for at least one day. Students can measure the various layers to compare the amounts of the various components (clay, silt, sand, gravel, humus) in each soil sample. Measurements can be displayed using bar graphs. This activity can be used to address grade 3 mathematics outcomes (GCO F).

Students can take soil samples and sieve them through mesh/screen of progressively smaller openings, such as chicken wire, colanders, and flour sieves. Students can compare and record the amounts of materials that result from the consecutive screenings.

From their explorations, students will be able to see similarities and differences in the soil samples and can draw pictures that show patterns that emerge from their settling investigations. They can compare and describe soils (particle size, colour, texture) from many locations. Ultimately, they will see that soil composition varies from one place to another.

Investigating Soils Composition

Tasks for Instruction and/or Assessment

Performance

- Take your soil sample, put it in a clear plastic container, and add water until it is three-quarters full. Put the lid on, and shake it. Watch the contents settle.
  - As you watch the particles settle, do you notice any patterns?
  - Let the container settle overnight. Draw a picture of the settled soil in the container in your science log.
  - Compare your soil sample composition with that of other classmates. (100-36, 100-37, 201-3, 201-5)
- Using different sizes of screening materials (chicken wire, colander, flour sieve), separate your soil sample into different piles, one for each screening material.

  Describe the materials in each of your piles. Are all the types of particles the same, or are they different? Compare the sizes of the piles that you have made. Measurements can be displayed as a bar graph. (100-36, 100-37, 201-3, 201-5)

Paper and Pencil

- Predict what kinds of layers you are going to have after your soil sample settles. (200-1, 200-3)

Resources/Notes

Appendix F Activities

- Activity 12: Different Types of Soil
- Activity 13: Investigating Soil
- Activity 14: Screening Your Soil

Print

- *Down Under*, Teacher's Guide (Pan-Canadian Science Place), pp. 12–30, 39–43, 62–71 (16595)
- *The Underground Dance* (big book) (13349)
- See Appendix I: Print Resources

Video

- *The Secrets of Dr. Soil* (21558) (30 min.)

Curriculum Links

- See Math: GCO D (volume)

Water Absorption of Soils

Outcomes

Students will be expected to

- describe, predict, and compare the absorption of water by different types of soil (100-38, 200-3)
- communicate procedures and results of investigations related to water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions (203-3)

Elaborations—Strategies for Learning and Teaching

Students can investigate what happens when various types of soils become wet. Do they feel different, pile up differently, hold together differently? Are some soil types better for making mud pies than others? Do some soil types stick together better after drying? Do some soils hold more water than others?

In their explorations, students may notice that some soil samples seem to absorb more water than others. They can make predictions about which soil samples they think will absorb the most and then test their predictions with detailed investigations.

To test the water absorption abilities of various soil samples, students can put the same amount of each (for example, sandy soil, gravelly soil, loam, potting soil, clay soil) in plastic cups with small holes poked in the bottom. (A variety of soil types can be obtained from hardware stores or garden shops.) Students can pour an equal amount of water on each sample and measure the amount of water that drains through, noting which one retained the most, and how much water was retained by each sample. A discussion of variables that might affect their result might highlight, for example, the effect of taking soil samples after a rainy day versus taking soil samples in the middle of a dry spell.

Students can practise their graphing with both of these activities (mathematics outcome F3).

As students are finishing up their work on soil retention, teachers can ask them to think about questions such as When would you want to have soil that absorbs lots of water? When would you not want this? When would you want to have good drainage? Students may have noticed in the unit Plant Growth and Changes that some plants grow better in dry, well-drained soil, while others need to have very wet soil. They may note that their driveways are often constructed with gravel that allows water to drain away, while a layer of topsoil is usually put over gravel on lawns to provide water absorption for grass, as well as the necessary nutrients for its growth.

Water Absorption of Soils

Tasks for Instruction and/or Assessment

Performance

- Complete the chart as you investigate the effect of water on different soil types. (200-3, 100-38)

Properties of Soils

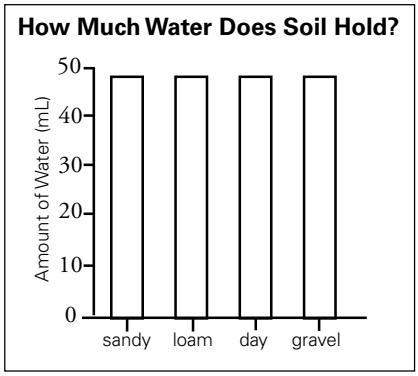
Type of Soil (clay, sandy, loamy, etc.)	Colour, Texture, and Size (drawing of sample particle)	Ability to Hold Together When Dry	Ability to Hold Together When Wet	Colour When Wet
clay	tiny reddish particles	can squish together, but will fall apart easily	clumps together and can form a ball	reddish-brown

- Put four or five small holes (using the size of a skewer) in the bottom of a styrofoam cup. Put 125 mL of soil in the cup.

  Hold it over another styrofoam cup, and pour 125 mL of water over the soil. Measure the amount of water that drips out. Record your results in the chart.

Amount of Water Absorbed in Soil

Soil Type or Description	Amount of Water Absorbed
sandy	
loam or potting soil	
clay	



Compare your results to your classmates' for different types of soils, and draw a bar chart to display class results. (203-3)

Resources/Notes

Appendix F Activities

- Activity 15: Absorption of Water
- Activity 16: Texture of Moistened Soil
- Activity 17: Mystery Soils

Print

- *Down Under*, Teacher's Guide (Pan-Canadian Science Place), pp. 49–57 (16595)
- See Appendix I: Print Resources

Curriculum Links

- See Math: GCO F

Moving Water and Soil

Outcomes

Students will be expected to

- observe and describe the effects of moving water on different types of soil (100-39)

Elaborations—Strategies for Learning and Teaching

Students should record their procedures and investigations, using drawings, demonstrations, and written/oral presentations. As young scientists, students need this information if they wish to reproduce their results.

Students may be given the opportunity to observe the effects of moving water on soil in their own community where such evidence exists. From their previous experiences, have students discuss possible effects of moving water on various types of soil. Have students suggest methods they could try in class to test their suggestions. Students can observe and describe patterns in soil that result from running water. For example, students can explore which soil materials move readily with water and which do not. They can pour water from a watering can on a pile of soil that contains a range of particle sizes and record their observations. On a smaller scale, students can pour water at one end of a cake pan containing sand or soil and observe and describe what happens to the soil. They can observe and describe patterns in soil that result from running water by noting changes in their schoolyard after a particularly heavy rain, looking at the ground near an eavestrough runoff, and noting the banks of rivers, creeks, streams, and culverts.

Caution: It is advisable to wear gloves when working with soil.

The following activity could be done in conjunction with activities from the unit on Plant Growth and Changes. Given a pile of soil, students can investigate different methods of preventing the soil from washing away. One thing they might try is to investigate the effect of plant growth on erosion. Students put planting soil in a number of small aluminum foil pie plates with a few holes in the bottom for drainage. They plant grass seed in one and various other seeds in the rest, leaving one pie plate with soil alone as the control. When the seeds have grown into plants, students can run equal amounts of water on one side of the tipped pie plates and note which plate has more soil running away from it. Students may also wish to test other means to prevent erosion, such as stretching nylon stockings or other meshed material over the pie plates. (Netting is sometimes used to prevent soil erosion on the slopes beside new highways. It provides a means of preventing erosion until grass or other plants can grow.) They can make ridges in the soil that run perpendicular to the flow of water (contour plowing). (This is a common technique used by farmers when plowing on hills.)

Students can look for evidence in their community of erosion-prevention strategies that are being used. For example, grass is often planted on the banks of highways to prevent the soil from washing away.

Moving Water and Soil

Tasks for Instruction and/or Assessment

Performance

- Take a soil sample with different particle sizes in it. Put it in a cake pan and pour 250 mL of water on top of it. What happens to the soil? Do you notice any difference between the types of particles that were washed away and the ones that stayed? (100-39)
- Go outside the school and look at the ground near a water runoff from the school roof (eavestrough). What do you notice about the soil there? (100-39)

Journal

- Record your observations and describe the effects of moving water on different types of soil. Label your drawing and write a description to go with it. (100-39)

Resources/Notes

Appendix F Activities

- Activity 18: Water and Soil
- Activity 19: Moving Water and Different Types of Soil
- Activity 20: Moving Water/ Soil/Plants

Print

- *Down Under*, Teacher's Guide (Pan-Canadian Science Place), pp. 58–61 (16595)
- See Appendix I: Print Resources

Curriculum Links

- See Math: GCO D (volume)

Interactions of Living Things and Soils

Outcomes

Students will be expected to

- investigate and describe how living things affect and are affected by soils (100-35)

Elaborations—Strategies for Learning and Teaching

Investigations will focus on the following:

- investigating and describing living things found in the soil
- investigating plant roots and describing how they spread through the soil
- investigating and describing recycling of biological materials in soils

Students can spread a sample of soil on a white sheet of plastic to observe what crawls out of and through the soil. They can lift rocks or other ground coverings to see the insects that are under them. They can compare the insects and grubs that live in a variety of soils (e.g., clay, loam). Students can put different soil samples in plastic bags or small jars with some of these living things and observe how they move through the soil, what they seem to be eating, and any signs of droppings. A plastic bag or an ant farm or similar device made with two sheets of acrylic plastic held about 2 cm apart, with soil, insects, worms, and grubs in it would provide opportunities for closer observation. Where appropriate, have students observe in a natural setting.

Outcomes from this section complement outcomes from the grade 3 unit Plant Growth and Change. Students can investigate plant roots and describe how they spread through the soil. They can place a moist paper towel around the inside of a glass jar or plastic bag, put some soil in centre, and place popcorn (unpopped) between the glass and paper towel. Popcorn will sprout, and roots and leaves will be visible to observe.

Students can make classroom compost by collecting food scraps (such as apple cores) from lunches and putting it in a plastic ice cream container. They can put some holes in the top so that air can get in and out, bring in some bugs/worms to add to the container, and let the food decompose. This can be kept outside, but since the months that school is open are fairly cold, small amounts can be kept inside to speed up the process. Students can explore the advantages of composting and the uses for compost material.

Students can also explore the decomposing of materials by investigating leaf litter. In the fall, students can pile up fallen leaves, and then in the spring, they can dig around them to see how much has decomposed.

Students can use other sources of information to find out more about how living things affect and are affected by soil. They may visit sites on the Internet on composting and watch videos or read magazines that highlight beetles, worms, slugs, or other soil creatures.

Interactions of Living Things and Soils

Tasks for Instruction and/or Assessment

Performance

- Take some soil and put it in a clear container. Pack the soil down fairly tightly. Put three or four worms on top of this soil, and observe the worms periodically throughout the next couple of days. What happens to the soil over the two days? In what way are worms good for soil? (100-35)
- Put some potting soil in a small, clear plastic cup. Plant some seeds and care for them as they germinate and grow. Look for evidence of the roots through the cup, and draw what you observe. What role does soil have for the functioning of roots? (100-35)
- In a plastic jar, put your vegetable or fruit scraps collected over a two-week period. Add a layer of soil on top. Store the container in a warm place for a long time (a couple of months at least). Stir things around daily and add small amounts of water. Record your observations in sentences and drawings during those periods. After your compost is finished, test it out. In one cup, plant your seeds in regular potting soil or dirt from around your school/home. In the second cup, mix your compost material with the soil, and plant the same kinds of seeds. Care for both cups the same way, and record your observations in a chart.

  Research and write a report on composting, and include this with your observations from your own compost. (100-35)

Using Compost

Date		**Mixture of Clay**	**Clay and Sand Mixed with**
(insert	Observations		
	Growth		
(one week	Observations		
	Growth		

Resources/Notes

Appendix F Activities

- Activity 21: Animals Underground
- Activity 22: Living Things in Soil—Animals/Insects
- Activity 23: Living Things in Soil—Plants

Print

- *Down Under*, Teacher's Guide (Pan-Canadian Science Place), pp. 31–38, 44–48, 62–71 (16595)
- *Ahmed and the Nest of Sand: A Piping Plover's Story* (13067)
- See Appendix I: Print Resources

Video

- *I Need the Earth and the Earth Needs Me* (20319) (20 min.)
- *Creepy, Crawly Creatures in Your Backyard* (23240) (16 min.)

Technological Products and Processes Related to Soil

Outcomes

Students will be expected to

- demonstrate and describe earth materials while exploring objects made from them (101-12, 203-1)

Elaborations—Strategies for Learning and Teaching

Students can use a variety of materials that come from the earth to make useful products. They can make some "pottery" from clay, experiment with different soil materials to make mud bricks, or collect small, colourful stones to use as decorations on objects such as empty tins that can be turned into pencil holders. They can make ceramic shapes or use beads to make jewellery. Stones can be painted for garden stones or stone art.

Displays of pictures or objects can be set up around the room to illustrate the many uses for earth materials. The displays could include earthenware or pottery, pictures of mud huts, bead jewellery, and various ceramic, brick, and concrete objects. Students may have objects at home that they could bring in and show to the rest of the class.

Technological Products and Processes Related to Soil

Tasks for Instruction and/or Assessment

Informal/Formal Observation

- Observe students as they work as a team to complete their products. Anecdotal records can be used to document their abilities to work as a team, communicate, and problem solve. (101-12, 203-1)

Presentation

- In a group of two or three, pick an "earth" product to make, and display your product for the class. (Alternatively, this activity could have everyone making the same type of product. This activity can provide opportunities for connections to art and social studies outcomes.) (101-12, 203-1)
- Bring in an earth product from home. Find out where the product was made, what it was made from, and what it is used for. Write this information clearly on a file card for display, and include it in a class display of earth products. (101-12, 203-1)

Resources/Notes

Appendix F Activities

- Activity 24: Uses of Earth Materials

Print

- *Down Under*, Teacher's Guide (Pan-Canadian Science Place), pp. 72–75 (16595)
- See Appendix I: Print Resources

Curriculum Links

- See Visual Arts: SCO 1.1.1, 1.2.1, 3.2.1

Physical Science: Invisible Forces

Introduction

Some forces involve direct pushes and pulls, where a surface is directly contacted, while others involve interaction at a distance. The intent of this unit is to introduce students to two kinds of forces that can act between objects where the objects need not be touching one other. Students learn that magnetic forces and static electric forces both involve attraction and repulsion, but have different origins and involve different kinds of materials. Students discover a variety of ways in which these forces can be applied or can affect their daily lives.

Although gravity is an invisible force, it is not addressed until the grade 5 unit Forces and Simple Machines.

Focus and Context

Inquiry, through observation and recording, is the focus in this unit. Through explorations into magnetic and static electric forces, students observe and record the materials and conditions that alter the strength of these forces. Investigations of electrostatic forces are best done in the winter, when the air is very dry.

Science Curriculum Links

Students first learned about the concept of forces in the grade 2 unit Relative Position and Motion during investigations into the factors that affect motion. This unit will extend students' experiences with two types of forces—magnetism and electrostatic forces. This exploration of forces will be extended in the grade 5 unit Forces and Simple Machines.

Curriculum Outcomes

The following outcomes have been developed from *Common Framework of Science Learning Outcomes, K to 12* pan-Canadian outcomes. See Appendix J for the original outcomes that these were derived from.

STSE/Knowledge	Skills
Students will be expected to	*Students will be expected to*
100-32 investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel	**100-31, 202-2** investigate to identify and group materials that can be magnetized or attracted by magnets and distinguish these from materials that are not attracted to magnets
102-14 identify familiar uses of magnets	**200-2, 201-1** follow procedures and identify problems related to strength of temporary magnets and to magnetizing materials
101-8 demonstrate and describe ways to use everyday materials to produce static electric charges and describe how charged materials interact	**200-3, 201-5** make predictions, record observations, and identify proposed questions about the number of objects that can be picked up by a magnet under different conditions
102-15 identify questions and describe examples of the effects of static electricity in their daily lives and ways in which it can be used safely or avoided	**201-3, 202-8** construct and evaluate a toy that is moved by magnetic forces
	100-33, 202-7 identify and investigate conditions that affect the force of magnets and of static electric materials (100-33, 202-7)

Magnetic Forces

Outcomes

Students will be expected to

- investigate to identify and group materials that can be magnetized or attracted by magnets and distinguish these from materials that are not attracted to magnets (100-31, 202-2)
- investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel (100-32)
- identify familiar uses of magnets (102-14)
- follow procedures and identify problems related to strength of temporary magnets and to magnetizing materials (200-2, 201-1)

Elaborations—Strategies for Learning and Teaching

Caution: Do not allow students to hold magnets near computers, computer discs, video or audio tapes, or television sets.

Teacher Note: *Since the designation of "north" and "south" on a magnet is an arbitrary standard, given unmarked magnets, students will be unable to tell which pole is which. Bar magnets on which the poles are marked can be used so students can see that opposite poles attract and like poles repel.*

Allow students time to investigate materials that can be magnetized. Students will be curious about which materials will attract magnets and will be eager to test out a wide variety of materials. They may encounter magnets that do not appear to be very strong or magnets that are so strong that pins or staples stay together after the magnet has been removed. These situations can lead to discussions and investigations into the strength of magnets and how to magnetize other materials such as pins and iron nails. Show them how to stroke an iron object or other magnetic metal with a magnet to make that object a magnet. They can then test materials to see if they can make them magnetic, as well try to make their weaker magnets stronger.

Students can follow a procedure where they select an iron nail, a magnet, and some staples and are instructed to stroke the nail five times in the same direction using the same end of the magnet. They can then put the iron nail into the staples and record the number of staples attracted. They can then repeat this procedure a number of times and test and record the number of staples that are attracted. Students need to be shown the proper way to handle and store magnets. Magnets gradually lose their strength if they are dropped repeatedly or stored improperly.

Students can investigate what magnets are used for. Bar magnets and horseshoe magnets can be explored to determine which objects are attracted to magnets and which are not. When students hold magnets together, they will very quickly discover that sometimes magnets attract, while other times they repel.

Magnetic Forces

Tasks for Instruction and/or Assessment

Performance

- Complete the table as you investigate magnets. (100-31, 202-2)

Will This Object Be Attracted to a Magnet?

Object	Prediction	Actual
paper clip		

- Set up some tests to find out which end is the north pole. Write up and draw observations and inferences. (100-32)
- In your home, look for ways in which magnets are used. Share your findings with the class (102-14)

Journal

- Today I learned about magnets ... (Look for words like **attract**, **repel**, **north**, and **south** in the students' descriptions of what they learned.) (100-32, 200-2)

Interview

- How can you magnetize an iron nail? How can you prove that it has become magnetized? (200-2)
- What is the correct way to store bar magnets? (200-2, 201-1)
- Are all metals attracted to magnets? (200-2, 201-1)
- How can you make this nail a stronger magnet? How can you make it weaker? (201-1, 200-2)

Resources/Notes

Appendix G Activities

- Activity 25: Pulling Together
- Activity 26: Push or Pull
- Activity 27: Magnetic Field
- Activity 28: Exploring Magnets
- Activity 29: Making a Magnet

Print

- *Invisible Power*, Teacher's Guide (Pan-Canadian Science Place), pp. 17–27, 34–57 (16594)
- See Appendix I: Print Resources

Magnetic Forces *(continued)*

Outcomes

Students will be expected to

- make predictions, record observations, and identify proposed questions about the number of objects that can be picked up by a magnet under different conditions (200-3, 201-5)
- construct and evaluate a toy that is moved by magnetic forces (201-3, 202-8)

Elaborations—Strategies for Learning and Teaching

Students can brainstorm conditions (e.g., intervening solids, distance from magnet) to test the strength of the magnets and then predict the number of staples that will be picked up. These predictions can be recorded in a chart.

Students can then test the strength of magnets or magnetized objects by counting how many objects a magnet can hold (e.g., paper clips, nails). From here they can then start to investigate the conditions identified in their brainstorming.

From their investigations, students will share their observations and make inferences to share with the class.

Students can identify places in their lives where magnets are used on a regular basis. They can make a simple toy or device that has a magnet on it and experiment with making it move using other magnets. Some students will choose to move their toys using attractive force, while others may use repulsion to get a better motion. Encourage them to work together, look at their options, and test out various ways of getting their toys to move. This could make a wonderful in-class co-operative project (Visual Arts link 2.1.1) for a group of two to three students or an at-home project.

Magnetic Forces *(continued)*

Tasks for Instruction and/or Assessment

Performance

- Complete the table as you investigate how to increase the magnetism of an iron nail. (200-3, 201-5)

Making a Nail a Stronger Magnet

Number of Strokes	Prediction of Number of Staples Attracted	Actual Number of Staples Attracted
0		
5		

- Use magnets and the materials provided to make a toy that you can move around. For example, a robot that can climb walls; a car that can be controlled. (201-3, 202-8)
- Complete the table as you investigate the factors that you think might affect the strength of a magnetic force. (201-5, 200-3)

Factors Affecting the Strength of a Magnet

Number of Sheets of Paper between Magnet and Staples	Number of Staples Picked Up	Distance from Magnet	Number of Staples Picked Up
1		0 cm	
2		1 cm	

Presentation

- Share and demonstrate to the class the magnetic toy that you made. Explain how it works, using terms like **attract** and **repel** and/or **pull** and **push**. (201-3, 202-8)

Resources/Notes

Appendix G Activities

- Activity 30: Strength of a Magnet
- Activity 31: Magnetism and Water
- Activity 32: Using Magnetism

Print

- *Invisible Power*, Teacher's Guide (Pan-Canadian Science Place), pp. 29–40, 84–88 (16594)
- See Appendix I: Print Resources

Curriculum Links

- See Visual Arts: SCO 2.1.1

Electrostatic Forces (Forces Arising from Static Electricity)

Outcomes

Students will be expected to

- demonstrate and describe ways to use everyday materials to produce static electric charges and describe how charged materials interact (101-8)
- identify and investigate conditions that affect the force of magnets and of static electric materials (100-33, 202-7)

Elaborations—Strategies for Learning and Teaching

This unit is best done in the winter when the air can be dry.

Students can start their explorations of static charges by rubbing a variety of materials together and seeing if the materials will then attract other objects, such as puffed rice, confetti, suspended pith balls or balloons, or any other objects they may wish to test.

Students can observe attraction and repulsion caused by static electricity using materials such as suspended balloons, fur, water, combs, and confetti. Students can rub two balloons with the same material (cotton, fur, or wool) and explore how the balloons interact, then record their results. They can also rub a balloon with one piece of material (e.g., fur), then rub other pairs of different materials together, and note how the suspended balloon interacts with each of these other materials. For each pair of materials, the balloon should be attracted to one and repel the other. Students can also see what happens when a charged material (e.g., wool that has been rubbed) touches the balloons. Students can make and record their observations and draw simple conclusions such as "some things cause more static."

Which Material Will Cause the Greatest Static Charge in Rubber?

Balloon Rubbed With	Amount of Confetti
cotton	not much
fur	
wool	lots

Teacher Note: *When some materials are rubbed, electrons will move from one material to another, and thus the materials will have opposite charges due to an excess of electrons on one of the materials (negative) and a reduction of electrons on the other (positive). If two balloons are rubbed with the same material, both balloons will have the same charge and will repel each other, but both will be attracted to the original material that they were rubbed with, since opposite charges attract. Any other pair of materials that are rubbed together can then be held close to the balloons, and one of the pair will attract the balloon, while the other will repel it. If a highly charged object is attracted to the balloon so much that it touches it, electrons will be transferred as they touch, so that both the balloon and the objects now hold the same charge and will repel each other.*

Electrostatic Forces (Forces Arising from Static Electricity)

Tasks for Instruction and/or Assessment

Performance

- Working in groups of two to four, try to find ways to attract the most puffed rice. Write down what you tried and the observations that you made. (100-33, 202-7)
- Complete the table as you investigate which materials will charge a balloon the most. When you are finished, write about what you discovered. (Students can repeat this activity with a garbage bag and a plastic drinking straw.) (100-33, 101-8, 202-7)

Which Material Will Cause the Greatest Static Charge in Rubber?

Balloon Rubbed With	Number of Puffed Rice
cotton	
fur	

Interview

- Have you ever stuck balloons to the wall? How did you do it? Did they stay very long? (101-8)
- How can you get two balloons that are suspended on threads to move away from each other? (101-8)

Resources/Notes

Appendix G Activities

- Activity 33: Static Electricity–Attract/Repel
- Activity 34: What Is Static Electricity?
- Activity 35: Zap-light and Static Electricity
- Activity 36: The Strength of Static Electricity

Print

- *Invisible Power*, Teacher's Guide (Pan-Canadian Science Place), pp. 64–78 (16594)
- See Appendix I: Print Resources

Electrostatic Forces (Forces Arising from Static Electricity) *(continued)*

Outcomes

Students will be expected to

- identify questions and describe examples of the effects of static electricity in their daily lives and ways in which it can be used safely or avoided (102-15)

Elaborations—Strategies for Learning and Teaching

Open discussion for students to share what they have found out about static cling from their investigations. Students should be encouraged to identify new questions that could be investigated at some other time based on their investigations. Some questions that students might ask are Do different types of clothes cause more static cling than others? Are clothes dried in a clothes dryer more static than the clothes on a clothes line? Give evidence to support your answer.

Products that inhibit static electricity (for example, spray products used for clothes) or use static electricity (dusters and new brooms that pick up dust using static charge attraction) can be displayed around the classroom. Students might explore techniques to reduce static attraction, "static cling," like making things moist or touching them to grounded metal. Students may relate this to how hair can stand up on end when combed.

Electrostatic Forces (Forces Arising from Static Electricity) *(continued)*

Tasks for Instruction and/or Assessment

Interview

- Describe what you know about static electricity and carpeted floors. (102-15)

Paper and Pencil

- Describe what happens when your clothes come out of the dryer. How do you think this is related to static cling? (102-15)

Presentation

- Create a poster that shows products that have been developed to reduce static (hair conditioners, sprays for clothes, static cling sheets for the dryer). (102-15)

Resources/Notes

Appendix G Activities

- Activity 37: Effects of Static Electricity
- Activity 38: Static Electricity: What I Have Learned

Print

- *Invisible Power*, Teacher's Guide (Pan-Canadian Science Place), pp. 64–78, 79–83 (16594)
- See Appendix I: Print Resources

Physical Science: Materials and Structures

Introduction

Students learn about the nature of materials, not just by observing them, but more importantly, by using them—sometimes in their original form and sometimes as things the students construct. The emphasis in this unit is on building things and on selecting and using materials to fit the task at hand. Students learn that the characteristics of structures they build, such as strength, are linked to the properties of the materials they use and to the particular way the materials are configured and joined.

Focus and Context

The focus in this unit is problem solving. Students should be provided with a number of challenges or design tasks over the course of this unit and asked to follow the steps in the problem-solving process to design solutions.

Proposing: Students should be given opportunities to research a variety of designs already in use and investigate the properties and ways of joining materials to see why they will be suitable for that particular task. They will then be in a position to propose solutions to the task or challenge.

Creating: Students gather materials and tools that they have chosen and design a solution to the task or challenge. This should involve revising the original plan as problems are encountered.

Testing: Students will test and evaluate their designs, compare them to other students' designs, and refine their designs as appropriate.

Students should be presented with several structural challenges or tasks that require the individuals or in small groups to complete the design technology cycle. These challenges should involve using a variety of materials, the acquisition of a variety of techniques for joining materials, and improving the strength and stability of structures.

Science Curriculum Links

Students have already distinguished between objects and materials in grade 1. This unit will provide the background necessary for a grade 5 unit, Properties and Changes of Materials, as well as give them the design skills necessary for the grade 6 unit Flight.

Curriculum Outcomes

The following outcomes have been developed from *Common Framework of Science Learning Outcomes, K to 12* pan-Canadian outcomes. See Appendix J for the original outcomes that these were derived from.

STSE/Knowledge	Skills
Students will be expected to	*Students will be expected to*
100-34, 101-11 describe, evaluate, and investigate common materials, their suitability for use in building structures, and ways to join materials together	**200-2** identify problems to be solved while creating structures
102-16 identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance	**200-5, 203-3** identify materials that could be used to solve the problem posed and suggest a plan for how they will be used through oral, written, and/or illustrated responses
102-17 evaluate simple structures to determine if they are effective and safe, if they make efficient use of materials, and if they are appropriate to the user and the environment	**101-10, 201-3, 201-8** safely use and follow safety procedures while using appropriate tools and materials to construct structures
	201-2, 203-5 manipulate materials and respond to the ideas of others to make changes in creating structures as deemed necessary
	202-8, 101-9 test the strength and stability of a personally built structure, identify ways to increase its strength, stability, form, and structure, and identify parts of the structure that failed

Proposing Solutions to Building Challenges

Outcomes

Students will be expected to

- identify problems to be solved while creating structures (200-2)
- describe, evaluate, and investigate common materials, their suitability for use in building structures, and ways to join materials together (100-34, 101-11)

Elaborations—Strategies for Learning and Teaching

In the initial stage of the design process students are given a challenge that requires them to build a structure out of materials. During the design process, students will encounter many problems (e.g., which materials to select, how to join them) that they will have to solve. Before the actual construction phase starts, students should focus on selecting the appropriate materials and designing a structure for the task. Bridges, towers, or egg-drop containers are common building challenges, but teachers and students can use their imaginations to think up other tasks that will encourage students to think creatively and critically in creating constructions and increase their awareness of a variety of design structures and materials that can be used in different situations. The task should be well defined, and the appropriate criteria (e.g., be able to hold 200 pennies, should have a minimum height of 1 metre) should be identified. In order to get the most out of this learning experience, students should take time in this initial stage to explore options, materials, and ways of joining them and look around them to see structures that have been built for similar reasons or structures exhibiting shapes that give stability and strength.

Students should explore and describe the properties of some everyday materials that can be used in their constructions. Samples of cardboard, putty, popsicle sticks, cotton balls, plastic, toothpicks, wooden blocks, paper, cans, Styrofoam, pipe cleaners, or straws should be available for students to use and evaluate their appropriateness. As they investigate the properties of these materials, they should be able to determine a situation or structure for which a particular material would be well suited. For example, cotton balls would not make a suitable material to build a house, but may make an excellent material for a bird's house or insulation or cushioning.

Students can also explore ways of joining materials. This would involve identifying and evaluating some common adhesive materials and identifying, evaluating, and applying ways of joining that involve the overlapping of components, the insertion of one component into another (paper clips into straws or toothpicks on peas), or the use of specialized components for joining such as staples or Velcro.

Proposing Solutions to Building Challenges

Tasks for Instruction and/or Assessment

Performance

- Make a list with the class of potential problems that might arise in building a structure. (200-2)
- Test out materials and ways of joining these materials in order to find out which ones would be most appropriate for your structure. (The development of the solution to this challenge will be continued throughout this unit.) (100-34, 101-11)
- Which glue works best for which material? Add a drop of each type of glue to each of the materials being tested, and let the glue dry. Test the glue by counting the number of pennies that can be supported on the join (or the number of paper clips that can be supported). (100-34, 101-11)

Journal

- Today we had to test materials to find out which ones we might want to use in our structure. Here is what we found out about trying to join these materials ... (100-34, 101-11)

Interview

- Which type of materials are you planning on using for your structure? What makes these materials good choices? (100-34, 101-11)

Paper and Pencil

- Match the material with the structure it is most suited for. (100-34, 101-11)

Material	Structure	Comments
cement	houses	for a basement
wood	sidewalks	for the summer
plastic	toys	easily break

Resources/Notes

Appendix H Activities

- Activity 39: Getting Started—The Tower
- Activity 40: Use of Materials
- Activity 41: My Fasteners and Their Uses
- Activity 42: Using My Fasteners
- Activity 43: Bonding Materials—Testing Glue

Print

- *Build It*, Teacher's Guide (Pan-Canadian Science Place), pp. 16–20, 25–35, 51–61, 72–74 (16593)
- See Appendix I: Print Resources

Video

- *Building Blocks* (22925) (15 min.)
- *Sticky Things* (22924) (15 min.)

Proposing Solutions to Building Challenges *(continued)*

Outcomes

Students will be expected to

- identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance (102-16)
- identify materials that could be used to solve the problem posed and suggest a plan for how they will be used through oral, written, and/or illustrated responses (200-5, 203-3)

Elaborations—Strategies for Learning and Teaching

Students can begin to explore building simple structures with shapes such as triangles and squares and testing these structures to see which structures provide the most stability and strength. From their examination of these structures, and as they are joining materials and constructing objects, they should recognize shapes such as triangles, columns, and arches and the importance of a strong, supportive base. Students can examine human-built structures such as umbrellas, stepladders, bridges, and towers; identify shapes within them; and describe reasons why these shapes are important to the structure. They can examine the symmetry in plants and animals and look at human-built objects that try to mimic this symmetry (compare the shape of a plane to that of a bird, for example). They can also look at structures built by animals, for example, bird nests or beaver lodges.

Once students have investigated various materials and ways of joining them, they can group them based on the function they could serve (e.g., strength, flexibility) and their suitability for the intended task.

Students can identify materials that would be best suited for a particular challenge and suggest a plan for their use. Alternatively, some materials can be identified by the class or teacher as being appropriate for the challenge, and limits can be put on how much of each material may be used in the construction. For example, a challenge could require students to build a structure to hold three apples, one on top of the other, using a 20 cm by 20 cm square of nylon netting and a bottle of glue. Both of these approaches have their advantages. The first approach does not limit the creativity of the student, while the second approach forces the students to think critically about how to best use a limited amount of material.

Have students draw a rough sketch of their plan in their science log before starting. They can then use this plan and refine it as necessary in the next stage of the design process. They may wish to include comments about dimensions, strength, durability, and so on.

Opportunities to hear from an architect about designing structures or to visit a construction site are valued experiences that will increase students' knowledge of the design and construction process.

Proposing Solutions to Building Challenges *(continued)*

Tasks for Instruction and/or Assessment

Performance

- Look at buildings and structures during one week. Keep track of shapes (e.g., rectangles, triangles) and structures (e.g., arches, columns) that you see. Use a digital camera or other device to record the structures. (102-16)

Journal

- Draw a sketch of your plan for building your structure. As you proceed through the construction phase, note any problems you had and how you solved them. (200-5, 203-3)

Paper and Pencil

- Sketch the shapes of the buildings and structures. Comment in your science log on their shapes, strength, stability, and/or balance. (102-16)

Resources/Notes

Appendix H Activities

- Activity 44: Structures and Shapes
- Activity 45: Bridges
- Activity 46: Building a Bridge Challenge—The Design

Print

- *Build It*, Teacher's Guide (Pan-Canadian Science Place), pp. 21–35, 43–57 (16593)
- *Homes Everywhere* (big book) (13581)
- *The Greedy Triangle* (16569)
- See Appendix I: Print Resources

Video

- *Shape and Strength* (20945) (20 min.)

Curriculum Links

- See Math: GCO E
- See Visual Arts: SCO 3.2.1, 6.1.1, 6.3.1

Creating Solutions to Structural Challenges

Outcomes

Students will be expected to

- safely use and follow safety procedures while using appropriate tools and materials to construct structures (101-10, 201-3, 201-8)
- manipulate materials and respond to the ideas of others to make changes in creating structures as deemed necessary (201-2, 203-5)

Elaborations—Strategies for Learning and Teaching

In this part of the design cycle, students make their structures using the materials provided. Students should work in pairs or small groups as they build their structure, and teachers should encourage them to work co-operatively together.

Tools and construction processes used during this unit should be age-appropriate. Students can use safety scissors, paper hole punch, school glue, or other tools deemed safe by teachers to cut, make holes, or join materials when constructing.

Students should be made aware of any important safety rules, such as not running with scissors and taking care with staplers. Students should be warned of the dangers of putting anything metal (e.g., scissors) in electrical sockets. Science safety is always appropriate to discuss with the students.

As students select their materials for their construction, they can estimate, for example, the number of straws or the amount of aluminum foil they might need.

There should be opportunities for students to try out their plan, encounter problems as they construct the structure, and problem solve together, sharing questions, ideas, and suggestions.

Teacher Note: *Teachers could make observations on these aspects of the activity as part of the assessment. Teachers allow opportunity for changes in the plans, and discuss these changes with students.*

Changes in their planning should be noted in their drawings and comments. Students should discuss with their partners reasons for the changes.

It is important to cover GCO D in math before this unit, and providing learning experiences during math time from GCO E simultaneously would integrate math and science meaningfully.

Creating Solutions to Structural Challenges

Tasks for Instruction and/or Assessment

Informal/Formal Observation

- Record to ensure
  - student uses tools safely
  - student knows the correct use for each tool
  - student communicates and works well within a group (101-10, 201-3, 201-8)

Performance

- Safely build the structure based on your plan of materials and how you are going to join them. As you work on your structure, talk with your partner about any problems you have and adjust your plan based on your discussions.
  - Design a bridge that allows two-way "dinkie" traffic. It should be strong enough to hold 10 cars at a time, must be able to span a distance of 50 cm, and must be 10 cm off the ground.
  - Design a tower that is 20 cm high and must be capable of holding a paper (or plastic) cup with 15 marbles in it while a fan set on medium speed is blowing on it from 0.5 m away.
  (201-2, 203-5)

Journal

- Problems that we had while building our structure were ... We solved them by ... (201-2, 203-5)

Interview

- Describe the structure you are building and how your project is progressing. (101-10, 201-3, 201-8)

Portfolio/Log

- Include your plans for your structure in your portfolio. Also include a report on the problems you encountered, and how you solved them. Use drawings to explain. (201-2, 203-5)

Resources/Notes

Appendix H Activities

- Activity 47: Building the Bridge Challenge
- Activity 48: Geometric Figures

Print

- *Build It*, Teacher's Guide (Pan-Canadian Science Place), pp. 31–65, 72–74 (16593)
- See Appendix I: Print Resources

Video

- *Bridges* (V2365) (15 min.)

Curriculum Links

- See Math: GCO D and GCO E
- See Visual Arts: SCO 2.1.1

Evaluating the Structural Solution

Outcomes

Students will be expected to

- test the strength and stability of a personally built structure, identify ways to increase its strength, stability, form, and structure, and identify parts of the structure that failed (101-9, 202-8)
- evaluate simple structures to determine if they are effective and safe, if they make efficient use of materials, and if they are appropriate to the user and the environment (102-17)

Elaborations—Strategies for Learning and Teaching

Once students have finished their structures, they should share what they have constructed with the rest of the class. The structures can be tested and evaluated. Students should focus on features of a design that give more strength, flexibility, or other specified characteristics. They can be given a chance to modify their designs or try constructing a new one based on what they have learned.

In the end, students should recognize that many designs are possible and there is no one "right" answer or product. Structures are evaluated on the basis of how they perform or suit the purpose for which they were designed. The design process itself is the main focus of this whole exercise. Teachers and students may wish to plan a rubric together before the tasks are started so that everyone is aware of the criteria and options. Students learn important strategies and techniques for working together, problem solving, testing their structures, refining their designs, and learning from their mistakes and from other students. Students may make a structure that does not function the way it was intended, but in the process may have learned more about structures and design than if they had not run into problems.

Evaluating the Structural Solution

Tasks for Instruction and/or Assessment

Performance

- Test your structure to see if it can do what it was designed for. Identify ways that you could improve your structure. (101-9, 202-8, 102-17)

Journal

- What I learned from my design is ... (101-9, 202-8, 102-17)

Presentation

- Present your structure to your classmates. Describe problems that you solved, changes you made, and your design strengths and weaknesses. (203-3, 102-17)

Resources/Notes

Appendix H Activities

- Activity 49: Our Bridge—The Final Structure
- Activity 50: A Building Challenge

Print

- *Build It*, Teacher's Guide (Pan-Canadian Science Place), pp. 12–20, 25–61, 72–80 (16593)
- See Appendix I: Print Resources

Appendices

Appendix A: Equipment Lists

School Materials

This suggested school list consists of items that each school should have to do the hands-on, minds-on science activities as outlined in this guide. This does not include items in the class or consumables list.

	Plants Appendix E	Soils Appendix F	Invisible Forces Appendix G	Materials and Structures Appendix H
Supply List				
aquarium	X			
ant farm		X		
attribute hoops				X
balances		X		
book on magnets			X	
brass fasteners				X
bulldog clips				X
colour printer (optional)	X			
compasses				X
computers (access to the Internet)	X			
construction barometer test				
construction paper		X		X
construction paper (green)		X		X
cubic metre set	X	X	X	X
digital camera	X			
economy stream table kit (set of 4)		X		
electric stop watch				X
fluorescent light bulb			X	
food scales		X		
funnels		X		
graduated beakers	X	X		
graduated cylinders		X		

	Plants Appendix E	Soils Appendix F	Invisible Forces Appendix G	Materials and Structures Appendix H
hammers		X		X
hot plate				X
Intel Microscope	X	X		
iron filings (oil free)			X	
large index cards				X
leaves and trees ready reference	X			
magnetic bingo chips			X	
magnetism poster			X	
magnetite			X	
magnetizer (high strength)			X	
magnets, ball			X	
magnets, bar (with N and S poles labelled)			X	
magnets, ceramic (ring and block)			X	
magnets, strip			X	
magnets, U shape			X	
magnets, wand			X	
magnifiers	X	X		
masking tape				X
medicine droppers		X		
metal pot				X
metre sticks	X			
metric masses		X		
metric measuring devices (mL, L)		X	X	X
metric measuring spoons		X		
metric tape measures	X			
microscope slide cover slips	X	X		
microscope slides	X	X		
microscopes/two-way viewers	X	X		

	Plants Appendix E	Soils Appendix F	Invisible Forces Appendix G	Materials and Structures Appendix H
modelling clay		X		X
natural magnetic loadstone			X	
overhead projector	X	X	X	X
page protectors or acetate sheets			X	
paper clips			X	X
pipe cleaners				X
pith balls			X	
plant pots	X			
rubber gloves		X		
rulers	X			X
safety goggles (junior size)		X		
screw drivers				X
shovels		X		
sieves		X		
soil-sampling tube		X		
soil thermometer		X		
sorting rings	X	X	X	X
staples			X	X
static tube			X	
stereomicroscope (optional, 1 per school)	X			
strainers		X		
stream table kit		X		
tabletop tripod magnifier	X	X		
thermometers	X	X		
trowels		X		
tweezers			X	
utility knife		X		

Classroom Supplies

This suggested classroom list consists of items that each class should have to do the hands-on, minds-on science activities as outlined in this guide. This does not include items listed in the other lists.

	Plants Appendix E	Soils Appendix F	Invisible Forces Appendix G	Materials and Structures Appendix H
Supply List				
crayons	X	X		X
glue	X	X		X
pencils	X			
scissors		X		X
stapler				X
Consumables				
alpha seeds	X			
aluminum foil			X	
balloons			X	
bean seeds	X			
blueberries	X			
celery, Chinese cabbage	X			
clay (self-hardening)		X		
corks			X	
corn starch				X
cotton balls				X
craft sticks				X
food colouring			X	
house plants	X	X		
lima beans	X			
liquids (various)			X	
mini marshmallows				X
needles (sewing)			X	X
paint (brown liquid Tempera)		X		
paint (liquid Tempera)		X		

	Plants Appendix E	Soils Appendix F	Invisible Forces Appendix G	Materials and Structures Appendix H
paper towel	X	X	X	X
pins, safety			X	X
pins, straight			X	X
pipe cleaners				X
plant starter	X			
plaster of Paris		X		
pond weed	X			
puffed rice			X	
rope				X
sand		X		
seeds (various types)	X			
snaps				X
soil (various types)	X	X		
sponge		X		
spoons		X		X
straws			X	X
string			X	X
thread			X	X
ticket board			X	X
tissue paper		X		X
toothpicks		X	X	X
twine				X
unpopped popcorn	X			
Velcro				X

Recyclables and Collectibles

This suggested recyclables and collectibles list consists of items that each class should have to do the hands-on, minds-on science activities as outlined in this guide. This does not include items listed in the other lists.

	Plants Appendix E	Soils Appendix F	Invisible Forces Appendix G	Materials and Structures Appendix H
Supply List				
2 L pop bottles	X	X		
aluminum cake pans		X		
cardboard			X	X
clear plastic cups	X		X	
cloth (various types of fabric)			X	X
combs			X	
fasteners (various)				X
flowering plants	X	X		
fuzzy socks			X	
gravel		X		
jars (clear)	X	X		
large pot				X
magazines with pictures of flowering plants/structures	X			X
marbles				X
milk cartons	X		X	
nails		X	X	X
newspaper		X		X
pea gravel		X		
photos of burrowing animals		X		
pictures of bridges				X
pictures of structures made by animals				X
pictures of towers				X
plastic		X	X	
plastic bags	X	X		

	Plants Appendix E	Soils Appendix F	Invisible Forces Appendix G	Materials and Structures Appendix H
plastic containers	X	X		
plastic figures (animals/insects)		X		
sawdust		X		
screws				X
seed catalogues	X			
shoe boxes		X		
small plants	X	X		
toilet tissue rolls		X		
water	X	X	X	
watering can	X			
wood		X	X	X
wooden spoons	X			X
wool (natural undyed)			X	
wrapping paper				X

Appendix B: Video Resources

Education Media Library

The Education Media Library has over 5000 titles in its video collection. All programs have been evaluated for curriculum fit and are intended to support the Nova Scotia Public School Program. They may be used by teachers and others engaged in public education in Nova Scotia. Public performance rights have been purchased so that all videos can be shown in classroom settings to students and educators.

The Media Library offers video loans and video dubbing services. Loan videos have an assigned number that begins with the number 2, e.g., 23456. These videos may be borrowed and returned. The videos that are available through dubbing begin with a V, e.g., V1123. The Media Library makes a copy of these videos, which is then retained by the client. Dubbing services are provided for the nominal recovery cost of the videocassette on which the programs are taped. Tape prices range from $1.44 for a 20-minute tape to $2.59 for a two-hour tape. Programs can be stacked onto one tape (e.g., four 30-minute programs onto one tape) or be dubbed on separate tapes.

The Learning Resources and Technology website <lrt.EDnet.ns.ca> provides a rich variety of curriculum-related resources to help teachers in their classrooms. Teachers can search the video database, find out about educational software, search the database of curriculum-related websites, download curriculum catalogues, access workshops on web safety, and find tips on integrating technology into the classroom.

Title	Description
Life Science: Plant Growth and Changes	
The Environment: It's Ours to Look After (V0588) 12 min., 1989	This film defines environmental terms and issues simply, taking a child's close-to-home viewpoint. In four segments, this colourful slide-tape-to-video transfer explores acid rain, environment, pollution, and the importance of trees.
Fifty Simple Things Kids Can Do to Save the Earth (22648) 47 min., 1992	This video by children and for children shows what is being done to clean up the Earth, and what viewers can do to help.
Flowering Plants: From Seed to Seed (21932) 11 min., 1980	This program examines the development of a common plant, the tomato, using time-lapse photography. Germination, photosynthesis, the development of true leaves and flower buds, pollination, the development of the fruit and seed, and the beginning of the new life cycle are shown.
Growing (V2369) 15 min., 1996	This program from the Life and Living series demonstrates what seeds need to grow, the growing process using several experiments, and time-lapse photography of how plants cross-pollinate and produce seeds.
Habitats (23318) 18 min., 2000	This program features the importance of habitats of plants and animals with live-action and animation. Students will explore the tundra, desert, grassland, forests, and waterways of the world and learn about the plants and animals that live there.
Habitats: Homes for Living Things (23324) 15 min., 2000	This program explores how plants and animals meet their needs to live and grow. Students will visit a pond, a desert, a forest, a rainforest, and other habitats to discover how plants and animals adapt to survive in different environments and landscapes.
Living and Non-Living Things (23328) 12 min., 2000	From this video, students will be able to identify and describe the needs of living things. They will recognize that plants are living things, see how they meet their needs, and how they move, grow, and change.
Plants: A First Look (23315) 17 min., 2000	This video shows a variety of plant types in different settings as diverse as deserts, tropical rainforests, and students' own backyards. The program shows how plants are similar to other living things and how they are different. It describes different plants and how they function. It shows students performing simple experiments with plants to do at home or school.

Title	Description
Plants and Their Importance (23326) 15 min., 1998	This program shows how plants are the basis of food chains and are capable of making their own food. It shows different species of plants and identifies how different plants are used for food, oxygen, clothing, and building materials.
Plants in Nova Scotia (V2429) 10 min., 2000	This program is an overview illustrating the diversity of native plants in the province, as well as basic distinctions between their many categories.
Seeds in Motion (23035) 15 min., 1989	This video uses time-lapse photography to show the many ways that plants scatter their seeds.
Sunflowers (21661) 10 min., 1995	Who will win the flower-growing competition? What is needed to make plants grow? This video explains the conditions needed for plant growth.
What Is a Garden? (23341) 4 min., 1999	This short program from the What If … ? Series moves deep into the world of the garden, providing close-ups of stems, flowers, and leaves, giving a new perspective on familiar parts. Video without words has a background of natural sound.
What Makes a Plant a Plant? (23337) 15 min., 2000	This short video shows that plants are like humans—they need water and air and must grow and reproduce—but are different in that they make their own food. Animated graphics illustrate parts similar in all plants as well as their worldwide diversity.
Where Do Plants Come From? (23336) 15 min., 2000	Students will see seasonal changes and an animated wheel of how plants fit into the life cycle of nature. Computer animation permits students to see how pollination and plant ecological relationships work.
Wonders of Growing Plants (21490) 14 min., 1993	In a school setting, a teacher and children discover various ways that plants grow from seeds, stem, leaves, and roots. The students perform experiments in which they plant lima bean seeds in a glass of water, which we watch grow in time-lapse photography. In a similar way, we learn about growth starting from a stem, a piggyback leaf, and sweet potato.

Title	Description
Earth and Space Science: Exploring Soils	
Biodiversity—Garbage (23115) 50 min., 1995	In any given environment there is biodiversity; that is there are hundreds of varieties of plants and animals living together creating ecosystems. Bill Nye, the Science Guy, sets up shop in an ocean, forest, and a field to commune with nature and show what happens when one link falls out of nature's chain. By digging up the dirt on garbage in ever-expanding landfills, Bill Nye, the Science Guy, exposes the vast amount of non-biodegradable waste humans create. This tape has two 25-minute programs.
Buried Treasure (21667) 10 min., 1995	The animals store some of their food against future shortages, but are dismayed to find that much of it has rotted. Concepts include decomposition and preservation. This is from Fourways Farm Series 2.
Creepy, Crawly Creatures in Your Backyard (23240) (Closed Captioned) 16 min., 1996	They are crawling in your cabinets, wriggling in your rhododendrons, burrowing in your backyard. Meet your puny and sometimes pesky neighbours and discover the importance of the services they perform from tilling the soil to controlling dangerous pests.
Garbage Tale: An Environmental Adventure (22242) 18 min., 1990	In this delightful fantasy, young Ernie discovers where his garbage really goes. He travels to landfills, incinerators, compost bins and recycling centres. He learns about resources and pollution, about recycling, reducing what we use and re-use, in an effort to live in harmony with the Earth.
I Need the Earth and the Earth Needs Me (20319) 20 min., 1990	This program explains that all plants and animals, including people rely on the air, water, and soil for survival and enjoyment. In focussed sections, the program outlines sources of pollution and the efforts scientists and ordinary citizens are taking to preserve the quality of air, water, and land environments.
Puzzle of the Rotting Log (22432) 15 min., 1990	Nature guide Jim poses the question to a group of elementary children: If trees have been living and dying on Earth for thousands of years, how come the Earth is not covered with dead trees? The children in this video explore the woods in an effort to solve the puzzle and learn about decomposition and nature's unique recycling system.
The Secrets of Dr. Soil (21558) 30 min., 1994	*The Secrets of Dr. Soil* is about soil—what's in it, how it forms, what builds it up, what breaks it down, and what everyone can do to preserve this precious, renewable resource.

Title	Description
Physical Science: Invisible Forces	
Animal Magnetism (21665) 10 min., 1995	The animals are trying to move things without touching them, and they are apparently able to move objects magically.
Appropriate Measures (21666) 10 min., 1995	Ginger the cat's box is broken during a game and the animals try to replace it; however, the ideas of measurement cause problems.
Physical Science: Materials and Structures	
Bridges (V2365) 15 min., 1995	The history of bridges and the problems resolved with each new design and construction method—beam, arch, cantilever, keystone, draw, suspension, swing, and aqueducts are described.
Building Blocks (22925) 15 min., 1998	This program begins showing beehives and honeycombs as a strong shape and then moves to buildings that humans create. The program includes the natural creation of dams and beavers and their building ability.
How Do They ... Recycle Paper? (23352) 4 min., 1999	This short video without words examines what happens to the paper we put in our recycling boxes. Includes a brief teacher's guide printed on the video jacket. It is from the How Do They ... ? series.
How Do They ... Recycle Steel? (23353) 4 min., 1999	This short video without words will show students how sparks fly and molten metal run white hot on its way from scrap to fresh steel. It includes a brief teacher's guide printed on the video jacket and is from the How Do They ... ? series.
Shape and Strength (20945) 20 min., 1986	*Shape and Strength* examines how shape maximizes or minimizes the strength of objects. Students measure the forces required to collapse different materials and objects made from them, and then try to design a bridge using shapes to maximize its strength. The program points out how we use strong shapes to protect things from damage.
Sticky Things (22924) 15 min., 1998	The invention and uses of Velcro, a natural inspiration from plant burrs, and natural and artificial adhesives including "Post-it notes."

Title	Description
What Is … a Door? (23343) 4 min., 1998	This short program from the What Is … ? series provides a journey through the hidden secrets and familiar sights and sounds of doors. This video with natural sounds, without words, uses familiar objects to look beyond their everyday use. Notes are included on the video jacket.
What Is … a Wall? (23344) 4 min., 1999	This short program from the What Is … ? series provides close up look of the walls of a house, turning planes of light, shadow, colour, and texture. This video with natural sounds, without words, uses familiar objects to look beyond their everyday use. Notes are included on the video jacket.

Appendix C: Classroom Management

Group Organization

Many of the science activities presented involve children working in small groups of 3–4 students. For some of our young students, this may be one of their first opportunities to work co-operatively with others, sharing resources and ideas. To make these group experiences more productive, you may find it helpful to assign rules/tasks to the members of each group.

Sample Members and Tasks

Collector	Recorder	Reporter	Group Member
• gathers supplies • puts supplies away • cleans up	• asks group for ideas • writes down group's ideas • ensures that all members have completed their work	• shows what the group did • explains what the group did	• listens • participates • shares

Assessment Rubric

A comprehensive evaluation of a student's progress in science should include a performance-based assessment. Areas for consideration may include

- problem comprehension
- co-operative learning
- problem solving
- equipment use
- communication of results

The rubric on the following page may be used for performance-based assessment. Ideally, a student will be assessed every few weeks, and one or more students may be observed during each activity. The child is informally observed during the activity, and the observed levels of achievement are highlighted on the rubric. The dated rubric may then be added to the child's assessment portfolio and referred to for evaluation. Levels of performance and progress are easily tracked and any areas of concern identified.

The use of a clipboard and highlighter allows for ease of recording as observations are made.

Performance Assessment Rubric

Name:	**Date:**
Activity:	

Problem Comprehension

4 has complete understanding of the problem
3 understands most of the problem
2 understands some of the problem
1 tries but does not understand the problem
0 makes no attempt to understand the problem

Problem Solving

4 has a plan that could lead to the correct solution
3 follows basic procedure with minor error or omission
2 follows partially correct procedure with major error
1 plans inappropriately
0 makes no attempt to solve the problem

Co-operative Learning

4 consistently encourages work toward the group goals with skill and sensitivity
3 fulfils individual role with skill and sensitivity without prompting
2 fulfils individual role with sensitivity but needs occasional prompting
1 contributes only when prompted and needs reminders regarding sensitivity
0 refuses to work as a group member and/or shows no consideration for others

Equipment Use

4 accurately uses all appropriate tools to gather data
3 effectively uses some of the appropriate tools to gather data with minor errors
2 attempts to use the appropriate tools resulting in inaccurate data
1 does not use the appropriate tools
0 makes no attempt to collect data using the tools

Communication of Results

4 gives concise explanation of method with conclusion based on data collected
3 gives satisfactory explanation of method with conclusion based on data collected
2 gives incomplete explanation of method and/or conclusion partially supported by data
1 gives explanation that cannot be understood/makes no reference to data
0 gives no explanation/gives no conclusion/presents no data

Appendix D: Journals and Logbooks

Logbooks and journals are a part of many occupations and as such are highly reflective of the world of work. Many highly successful people keep a daily journal as a habit that helps them develop insights into their work. A journal can include sketches, diagrams, notes, quotes, questions, excerpts, and drafts. Scientists recording this way are keeping track of all their observations and so on. This is their "private science."

The logbook or journal may be used to develop a final product, such as a report, design, profile, fictional text, or dramatization, or it may be a way of tracking progress and developing ideas and insights. The final product is the young scientists "Public Science."

Students need to see the value of their science log writing, not only through frequent responses from the teacher, including assessments that "count," but also through assignments that provide linkages to previous and subsequent learning or that meet specific learning and/or personal needs for the student.

Since the logbook or journal can contain very personal thoughts and ideas stimulated by thought-provoking questions, the teacher must make provisions to honour the confidentiality of students' work, except where legally required to do otherwise.

Elements of the following journal assessment rubrics can be used in various combinations.

Journal Comment Rubric

Name:	**Comments**:
Ideas • interprets and analyses issues • describes new insight(s)	
Critical Thinking • identifies assumptions underlying an issue, problem, or point of view • probes beneath the surface for layers of significance • explains an issue from multiple perspectives	
Ethical Reasoning • uses rules or standards of right/wrong or good/bad to guide debate/reflection	
Personal Experience • connects insights/thoughts to personal experience	
Development • develops content thoroughly	

Journal Scoring Rubric

	1	2	3	Assessment Student/Teacher	
Ideas	states facts	interprets and/or analyses an issue	interprets, analyses, and describes a new insight(s)		
Critical Thinking	responds to a stated issue, problem, or point of view	identifies assumptions underlying an issue, problem, or point of view	questions assumptions underlying an issue, problem, or point of view		
Critical Thinking	responds to a stated issue, problem, or point of view	identifies more than one layer of significance	probes beneath the surface for multiple layers of significance		
Critical Thinking	describes a single response to a situation or problem	describes several responses to a situation or problem	sees implications of alternative responses to a situation or problem		
Critical Thinking	explains an issue from one perspective	explains an issue from more than one perspective	explains an issue from multiple perspectives		
Ethical Reasoning	does not consider ethical aspects of issues	recognizes and often applies standards/rules	uses rules or standards of right/wrong or good/bad to guide debate/reflection		
Personal Experience	does not personalize journal	makes some connection to personal experience	connects insights and thoughts to personal experience		
Development	develops content minimally	develops content adequately	develops content thoroughly		
Name:			**Score:**		

Appendix E: Activities for Life Science: Plant Growth and Changes

In the following appendices (E–H), you will find activities you may wish to use or modify to support student achievement in meeting specific curriculum outcomes at the grade 3 level. These activities are referenced under column four, Resources/Notes, in each unit on the two-page spread and are meant to add to other hands-on learning experiences teachers may provide to meet curriculum outcomes.

You can also find well-written, easy-to-follow activities and curriculum links to science in the following resource in, or available to, schools through the Nova Scotia School Book Bureau:

Pan-Canadian Science Place, Complete Grade Three Unit (NSSBB #13929)

Activity 1: Seeds

Outcome

Students will be expected to

- place seeds in groups according to one or more attributes (202-2)

Assessment

- Students are able to sort seeds using one or more attributes.
- Students are able to describe the various attributes of their seeds.
- Students are able to explain the reasons for their sorting method(s).

Questions

- What do some or all of the seeds have in common?
- How do the sizes of the seeds vary?
- What types of plants do you think the seeds might come from?

Materials

- various types of seeds (these can either be brought in by the students or by the teacher)
- activity chart (optional)
- sorting rings

Procedure

- Give each group of students a variety of seeds to sort and sorting rings.
- Have each group explain their sorting rule(s).
- Have students draw the seeds and write a description beside the drawing. The description should include the properties of the seeds such as the texture, colour size, smell, shape, and so on.
- Discuss with the students what they think is the purpose(s) of seeds.
- Have them write their responses in their science logs or journals.

Seeds Activity Sheet

Drawing of the Seeds	Description of the Seeds

Activity 2: Conditions for Plant Growth

Outcomes

Students will be expected to

- question and record relevant observations and measurements while investigating various growing conditions for plants (200-1, 201-5, 202-4)

Assessment

- Students are able to make predictions about which soils or conditions would be ideal for growing particular plants.
- Students are able to take their predictions and develop investigations to assess them.
- Students are able to carry out their investigations and record their results over a period of time.

Questions

- What types of conditions do particular plants need to grow?
- How would you test your predictions on plant growth?
- What materials would you need to carry out your investigations?
- How do we as humans help plants to grow?

Materials

- soil
- plants
- seeds
- materials as suggested by students
- recording sheet

Procedure

Begin this learning experience with a discussion on the types of plants, their needs, and their characteristics. You may wish to use one particular plant that students are familiar with as a basis for your discussions (marigolds, grass). From this students should work in groups and develop their investigation(s) as it relates to the questions. Students should record each step of their investigation. This activity may take several weeks as students grow their plants and carry out their investigation. You may wish to have students grow plants they have not grown in previous years. Students may wish to use different seeds (radish, herbs, grass, and nasturtium). As plants grow, students can make comparisons.

Students should record their findings in their science logs. Measurements, thoughts, lists, and graphs may be included also.

Conditions for Plant Growth Activity Sheet

Plant I am using for my investigation(s):	Materials I will need:
Description/plan I will use for my investigation:	
Comments	

Activity 3: How Well Is Your Plant Growing?

Outcome

Students will be expected to

- question and record relevant observations and measurements while investigating various growing conditions for plants (200-1, 201-5, 202-4)

Assessment

- Students are able to decide which unit of measurement is appropriate to measure the growth of their plants.
- Students are able to record relevant information in order to produce bar graphs that show the growth of their plant over a period of time.
- Students are able to grow plants from seed, observe plants they planted in the schoolyard or at their homes, and record their growth over a period of time.

Questions

- What unit of measurement would you use to measure the growth of a plant?
- At what intervals would you record the growth of your plant (daily, weekly, monthly)?
- In observing the various plants that students grew, was there one type that grew quicker than others? How were you able to determine this?
- Who might need or want measurements of plants?

Materials

- soil
- plants
- seeds (marigold, bean, pea, grass, etc.)
- measuring devices (rulers, metre sticks)
- plants
- activity sheet (optional)

Procedure

This activity is designed to have students meet with success in growing plants. Proper planting soil should be used, and it should be the same for all students. If your school has a naturalization area, you may want to take your students to a garden centre or have someone from a garden centre come to your school and recommend the type of plants that should be planted. Students should look at the seed packets for the size of the plants, spacing, and germination period. This could be done as a class project, and students could take turns measuring their plants and have a class bar graph to record the growth. Students should have the option to grow a variety of plants.

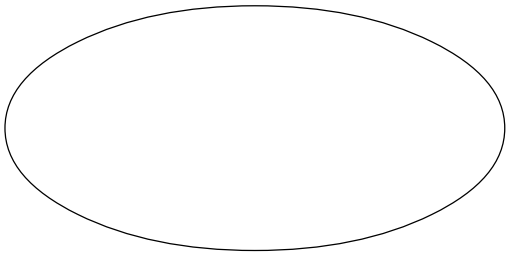
Students need to grow plants to watch them grow, watch what happens from too much or too little water, and see the cycle of plant growth.

The activity sheet could be used to record relevant information. From this information the students would produce their own bar graphs. Discussions should take place regarding who would use the data on the growth of plants and how they would use it. Discussions should take place regarding the spacing of plants and how farmers use this knowledge when planting their crops.

How Well Is Your Plant Growing? Activity Sheet

Type of plant I am growing: _____

Drawing of the seed I used:



Recording of plant growth:

Time Interval/Date	Height of Plant/Unit of Measurement

How Well Is Your Plant Growing? Activity Sheet

Time Interval/Date	Drawing/Description of the Plant

Activity 4: Parts of a Plant

Outcome

Students will be expected to

- identify and describe parts of plants and their general function (100-28)

Assessment

- Students are able to identify the parts of a plant.
- Students are able carry out an investigation to show the function of parts of plants.

Questions

- What are the parts of a flowering plant?
- What parts are common in many plants?
- How do the various parts of a plant help to support its growth?

Materials

- soil
- plants
- seeds
- models of plants
- celery or Chinese cabbage
- food colouring
- water
- clear plastic cups

Procedure

Take students for a walk around the neighbourhood. Have them write and illustrate in their science logs what they observed about the plants they saw. Have them describe and draw the various parts of the plants. In class, give students the opportunity to share their observations. A master list could be made for the class.

Give students the opportunity to grow their own plants. Have them use clear containers in order that they can observe the root systems of their plants.

Students could develop their own glossaries of terms along with illustrations as a means to keep a record of the parts of plants and their functions.

Plant Part Glossary

Plant	Parts	Edible or Not

Experiment: Have students place water in a clear plastic cup. Have them add a few drops of food colouring. Have them add a stalk of celery or Chinese cabbage to the water. They should mark the water level on the outside of the cup. Have them record what happens to the stalk and the level of water. Observations should take place over a one- to two-day period. Have them record their observations. Discuss with the students what they observed. Relate these discussions to growing plants.

Parts of a Plant Activity Sheet

Illustration of the stalk in the water and the water level on the first day:	Illustration of the water level and the stalk on the second day:
Description of what I observed:	

Activity 5: Parts of a Plant—The Seed

Outcome

Students will be expected to

- identify and describe parts of plants and their general function (100-28)

Assessment

- Students are able to identify various seeds and name the plants they come from.
- Students are able to record relevant observations regarding seeds and the plants they come from.
- Students are able to understand the importance of seeds.

Questions

- How are seeds important to the natural world?
- What function do seeds have in producing new plants?
- What are the various characteristics of seeds?
- Does the size of the seed always predict the size of the plant?

Materials

- various seeds
- an area to walk where students can observe seeds
- a gardening centre
- seed catalogues
- activity sheet (optional)

Procedure

In this learning experience students will gain knowledge and understanding of the importance of seeds as a part of plants. There are two times of the year when this activity can be most beneficial to students in observing the natural world. The spring is ideal to observe seeds from dandelions and maple trees. In the fall students would be able to observe seeds from beans, peas, chestnuts, corn, marigolds, grapes, blueberries, raspberries, and tomatoes. Seeds can also be purchased from stores and used for discussion and observation. Various types of fruit and vegetables could be brought into the class for students to open up and observe their seeds. Students could try to grow plants from the seeds. Students should be reminded that some seeds are poisonous (for example, peach seeds).

Parts of a Plant—The Seed Activity Sheet

Name of the Seed	Drawing of the Seed	Drawing of the Plant the the Seed Comes From

Activity 6: Light and Plants

Outcome

Students will be expected to

- identify, investigate, and suggest explanations for life needs of plants and describe how plants are affected by conditions in which they grow (100-29)

Assessment

- Students are able determine the impact that various amounts of light have on plants.
- Students are able to record their findings and report them to the class.

Questions

- What impact does the amount of light have on the growth of a plant?
- How does the amount of light affect the germination of a seed and its growth into a plant?
- What is a fair test? Describe how it works.

Materials

- seeds (bean, marigold)
- plants
- soil
- containers to hold plants
- activity sheet (optional)

Procedure

Students have had experiences with fair tests in previous grade levels. Review with students the term "fair test." Brainstorm with students what they think is the importance of light on the growth of plants. Record their answers on chart paper for future reference.

Tell students that they are now going to test their ideas. Have students develop a fair test for growing plants in various types of light.

Guide students to consider that

- the same type of soil should be used
- the same amount of soil should be used
- the same type of containers should be used
- if planting seeds, the seeds should be planted at the same time
- plants or soil should be watered at the same time of day, with the same amount of water
- if purchasing plants for the test, they should be of the same size and condition

Have students plant their seeds and put them in various types of light: dark cupboard, under fluorescent lights, under a grow light (a grow light is a special type of fluorescent light used for plant growth), in sunlight, under an incandescent bulb, etc.

Have students record their observations. Discuss with students their findings. Relate what they learned in class to real-life situations (greenhouses, plants in malls, plants in gardens, etc.).

Light and Plants Activity Sheet

Type of Plant	When I Watered It	Type of Light	Observations/Date of Observations

Activity 7: A Flowering Plant

Outcome

Students will be expected to

- observe, describe, and measure, using written language, pictures, charts, and graphs changes that occur through the life cycle of a flowering plant (201-3, 203-3, 202-4)

Assessment

- Students are able to distinguish the parts of a flowering plant and record their observations of it.
- Students are able to view the flower on a plant through a hand magnifier or an Intel Microscope.

Questions

- What differences did you observe among the flowering part of the plant and the stem, roots, and leaves?
- How would describe each part?

Materials

- flowering plants (either grown or from previous activities)
- hand magnifiers
- Intel Microscope
- activity sheet (optional)

Procedure

The focus of this activity is for students to be able to distinguish the flowering part of a plant from the other parts of the plant.

Students could either grow plants (marigolds are easy to grow) or use store-bought flowering plants or flowering plants from previous activities.

Have students record their observations in a chart. Discuss with students their findings.

Have students draw an appropriate graph of their information.

A Flowering Plant Activity Sheet

Part of the Flowering Plant	Description and Illustration
root	
leaf	
stem	
flower	

Activity 8: Stages of a Flowering Plant

Outcome

Students will be expected to

- observe, describe, and measure, using written language, pictures, charts, and graphs changes that occur through the life cycle of a flowering plant (201-3, 203-3, 202-4)

Assessment

- Students are able to sort the parts of a flowering plant and place them in order of how they would look in real life.

Question

- How were you able to sort the various parts of a flowering plant?

Materials

- pictures of stages of flowering plants cut up into cards for students to sort and place in order
- magazines with pictures of flowering plants
- digital camera
- colour printer
- sorting rings

Procedure

Option 1: Prepare cards that show the growing stages of flowering plants. These can be made by gluing pictures cut from magazines or digital images onto cardstock. The growing stages of a variety of flowering plants should be depicted (apples trees, tulips, marigolds, poinsettias, etc.). Give the prepared cards to the students and ask them to find other pictures of their plants and then put the cards in order according to the plant's life cycle. Give students the opportunity to name the various parts of the plants.

Option 2: Students in groups can draw or find their own flowering plants and make cards to be used by other groups.

Teacher Note: *The picture of the actual flowering plant could be placed on the opposite side of each card in order to help students distinguish among the various types of plants.*

Activity 9: Uses of Plants

Outcome

Students will be expected to

- describe ways in which plants are important to living things and to the environment and how the supply of useful plants is replenished (102-12, 102-13, 203-5)

Assessment

- Students are able to use a variety of resources to do research on a particular plant as it relates to the outcomes stated.
- Students are able to present the results of their research to the class through an oral presentation.

Questions

- How is a particular plant or part of the plant important to humans?
- What needs to be done in order to maintain/replenish a particular plant for it to continue to be of use to humans?

Materials

- various books on plants and their uses
- computers with access to the Internet
- speakers who can talk on topics related to the outcomes

Procedure

This activity is an excellent way to develop research skills with students and incorporate technology while focussing on science. Books, speakers, and the use of the Internet to collect information are key resources for this activity. Before students start their research, discuss with them what should be included in the project. Discussing a particular plant that students are familiar with would be an excellent way to begin. From these discussions the class could generate guidelines to follow when doing their research.

This could include, for example, name of the plant, where it is grown, what part of the plant is used by humans, how it is used, the importance of it, how it is replenished, the impact of it on humans. Students could also include a picture of the plant, the part used, the product, and a map of where it is grown. This could be an in-class project, or an at-home project.

Activity 10: Uses of Plants—A Nature Walk

Outcome

Students will be expected to

- describe ways in which plants are important to living things and to the environment and how the supply of useful plants is replenished (102-12, 102-13, 203-5)

Assessment

- Students are able to express, through observations, the importance of various plants to living things.
- Students are able, through observations, to record and express the importance of various parts of plants to living things.

Questions

- How are the plants in the area in which you live important to living things?
- What parts of the plants you observed are important to living things?

Materials

- plants
- activity sheet (optional)

Procedure

Prior to the start of this activity, ask students what type of plants grow in the area around the school and the neighbourhood. Tell them that they are going to go on a nature walk to observe the plants and record what they think their importance is to living things and how living things might use them or parts of them. Once you have returned, allow students time to share their observations and make a master list for the entire class. Discussions could include how students' observations might be different on a farm, in a forest, by the ocean, a lake, etc. If you have access to these areas or are able to go on a field trip to various areas or are able to walk around the school, this would be important to develop students' understanding of the importance of plants to all living things.

Uses of Plants—A Nature Walk Activity Sheet

Plant	Part of the Plant	Use to Living Things

Activity 11: The Artful Seed

Outcome

Students will be expected to

- describe ways in which plants are important to living things and to the environment and how the supply of useful plants is replenished (102-12, 102-13, 203-5)

Assessment

- Students are able to express their knowledge of seeds, where they come from, and how they can be used through art to show how plants are important to living things.
- Students are able to describe how their plant is important to living things.

Question

- Where do seeds come from?
- Do they have a life cycle?
- What do plants and other living things have in common?

Materials

- various types of seeds
- stencils of plants (optional)
- thick paper or cardboard
- glue

Procedure

Option 1: Students are given a choice of seeds to use. Have them draw or use a stencil of the plant the seeds came from. Have the students glue the seeds on their drawing to outline the plant or to fill it in. Have students name the type of plant and write a description indicating the importance of it to living things and how it is replenished.

Option 2: Students could create a scene with animals in it. The animals could be in a meadow, a garden, a tree, or a combination of all of these. Have students give their artwork a title to highlight the importance of plants to living things.

Appendix F: Activities for Earth and Space Science: Exploring Soils

Activity 12: Different Types of Soil

Outcome

Students will be expected to

- investigate, describe, and record a variety of soils and their components using words and diagrams (100-36, 100-37, 201-3, 201-5)

Assessment

- Students are able to observe and record the differences in various samples of soil.
- Students are able to suggest which soil samples would be good to grow plants in and which ones might not.

Questions

- What observations did you make of the differences among various soil samples?
- Which types of soil do you think would be good to grow plants in?
- How can you test your ideas?

Materials

- various types of soil samples (separated)
- plastic
- magnifiers
- newspaper
- activity sheet
- rubber gloves
- books on soil

Procedure

Have a variety of prepackaged soil samples. Give each group of students samples to observe. Have them use the activity sheet to record their observations. After students have completed the activity, discuss where they might find the various samples and how they might best be used in regard to plants and animals.

Different Types of Soil Activity Sheet

Soil Sample Number	Smell	Texture	Colour	Illustration

Activity 13: Investigating Soil

Outcomes

Students will be expected to

- ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- investigate, describe, and record a variety of soils and their components using words and diagrams (100-36, 100-37, 201-3, 201-5)

Assessment

- Students are able to use a variety of appropriate tools to investigate soil.
- Students are able to record their observations relating to their soil samples.
- Students are able to use language (both verbally and written) to describe the soil they are observing.

Questions

- What did you find in your soil sample?
- What tool(s) helped you to observe what was in your soil?

Materials

- trowels
- soil
- magnifying glasses
- Intel Microscope
- toothpicks
- rubber gloves
- newspaper
- plastic
- books on soil

Procedure

It would be beneficial to have students go out in the schoolyard and collect their own soil samples where possible. Care should be taken so that students do not harm plants or animals. If an area is not available, soil samples should be brought in from home or a garden centre. Students should be given the option to wear rubber gloves when handling soil.

Have students pour out their soil samples on the newspaper or plastic. Using magnifiers, have students look closely at the soil and record what they observe. (How does the soil feel? Does it have a smell? What does it look like?) Have the students sort through the soil. Have them illustrate what they observe. Have a group of students use the school's Intel Microscope to have a closer look at the soil. If the school has an LCD projector, you may want to show the sample to the whole class.

Discussions could take place on the importance of soil to plants and animals. Students should share hypotheses of what they think soil consists of.

Activity 14: Screening Your Soil

Outcomes

Students will be expected to

- ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- investigate, describe, and record a variety of soils and their components using words and diagrams (100-36, 100-37, 201-3, 201-5)

Assessment

- Students are able to use a variety of appropriate tools to investigate soil.
- Students are able to record their observations relating to their soil samples.
- Students are able to use language (both verbally and written) to describe the soil they are observing.

Questions

- What did you find in your soil sample?
- What did you observe about the particles of soil as the size of the holes in the sieves became smaller?

Materials

- soil sample(s)
- various sizes of screening/mesh (from hardware or building supply stores)
- colander
- flour sieve
- soil sieves from a scientific company
- magnifiers
- Intel Microscope

Procedure

The purpose of this activity is for students to observe the various sizes of particles that make up a soil sample. Students should start with mesh/screening with large openings and observe the soil. With the soil that has filtered through this, use the next size mesh and so on. After each time students should record observations with illustrations and descriptions in their science logs.

To make your own sieves, various sizes of mesh can be purchased at building supply or hardware stores. The mesh can be cut into 10 cm by 10 cm squares. The outer edges should be taped with masking tape or duct tape so that students do not cut themselves. The other option would be to purchase soil sieves from a scientific supply company.

Discuss with students their findings and leave time for students to share new questions that may arise as a result of their exploration.

Screening Your Soil Activity Sheet

Size of Mesh	Description of Soil Particles	Illustration of Soil Particles

Activity 15: Absorption of Water

Outcomes

Students will be expected to

- describe, predict, and compare the absorption of water by different types of soil (100-38, 200-3)
- communicate procedures and results of investigations related to water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions (203-3)

Assessment

- Students are able to predict and explain the reasons for their predictions.
- Students are able to measure amounts of soil and water using correct metric measurements (mL or L).
- Students are able to sort their samples in order of their ability to absorb water.
- Students are able to make appropriate bar graphs to represent their findings.
- Students are able to illustrate the results of their investigations.

Questions

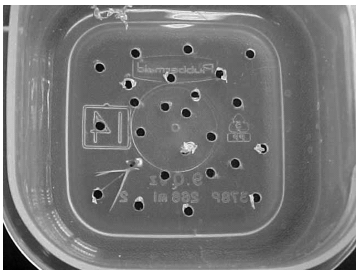
- Which soil sample absorbed the largest amount of water?
- How were you able to tell which soil sample absorbed the largest amount of water?
- Which metric units did you use to measure the amount of water absorbed by the soil?

Materials

- strainers with small holes (either made or purchased)
- soil samples (sandy soil, gravely soil, potting soil, clay soil, etc.)
- rubber gloves
- plastic containers
- safety glasses
- hammers
- nails
- wood
- metric measuring containers
- graduated cylinders
- balances
- metric masses

Procedure

Make a strainer using a plastic container (yogurt, ice cream), a nail, and a hammer. Have students make their own strainers by putting small holes in the bottom of plastic containers.



Have students share ideas on how they will measure the amount of water each soil absorbs. Remind students of ensuring a fair test.

Discuss with students the fact that they should use the same amount of soil and water for each test. Have students pour water on their soil samples. Have students record the amount of water the soil absorbed. This could be done by using a bar graph (Math SCO F3).

Ask the students to sort their soil samples from the least absorbent to the most absorbent. Have them illustrate and label their findings. Students should compare their results to those of others in the class.

On completion of this activity, discuss with students questions such as

- When would you want to have soil that absorbs a lot of water?
- When would you not want to have soil that absorbs a lot of water?
- When or where would you want to have good drainage? What type of soil would you need?

These discussions should be related to the area around where the students live. As a link to social studies, discuss other parts of the world where water and soil are located, e.g., the rainforest, desert, or tundra.

Activity 16: Texture of Moistened Soil

Outcome

Students will be expected to

- describe, predict, and compare the absorption of water by different types of soil (100-38, 200-3)

Assessment

- Students are able to distinguish the difference between dry and moist soil through observation and touch.
- Students are able to record the differences between various soil samples as related to their textures when they are moistened.
- Students are able to use the descriptions of soils in future activities to distinguish the difference between mystery soils.

Questions

- How did the texture of the soil sample change when it was moistened?
- How did the soil sample's ability to hold together change when it was moistened?

Materials

- soil samples (clay, sandy soil, loamy soil mixture of sand, silt, and clay)
- water
- metric measuring spoons
- medicine droppers
- activity sheet (optional)

Procedure

A variety of soil samples may be purchased from a local gardening centre or taken from around the school; only a small amount (2 mL) needs to be used.

Have students describe the texture of each sample of soil prior to moistening it. Have them record how it felt and the properties it had (gritty, fine, would not hold together, rough, colour). Next, have the students add a drop or two of water to their soil samples. Have them describe their soil sample (colour, texture, how well it compacts, thickness, density).

Discuss with students how knowing the various properties of soil would help living things and farmers when deciding what types of plants to grow on their farm.

Teacher Note: *Students should wash their hands after completing this activity.*

Texture of Moistened Soil Activity Sheet

Type of Soil Sample	Dry/Moist	Colour	Texture	Other Characteristics

Activity 17: Mystery Soils

Outcomes

Students will be expected to

- describe, predict, and compare the absorption of water by different types of soil (100-38, 200-3)
- communicate procedures and results of investigations related to water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions (203-3)

Assessment

- Students are able to distinguish the differences among soils through absorption and observation.
- Students are able to identify the types of soil samples provided through various tests.

Questions

- What types of tests will you do in order to determine the type of soil sample you were given?
- What materials will you need to complete the experiment?

Materials

- soil samples (clay, sandy soil, loamy soil mixture of sand, silt, and clay)
- water
- metric measuring spoons
- medicine droppers
- sieves
- metric measuring containers

Procedure

Give each group of students a soil sample that is not labelled. Using the data they have recorded on recognizing the various types of soils, ask students to design a set of tests to determine the type of soil they have been given. A review of the various tests they have completed should be done before they develop their own set of tests. Students should be encouraged to record their observations in chart form. For example:

Mystery Soils

Amount of Water Absorbed	Colour of the Soil When It Is Dry	Colour of the Soil When It Is Wet	Texture of the Soil When It Is Dry	Texture of the Soil When It Is Wet	What the Soil Looks Like Using a Hand-held Magnifier

Students should be encouraged to explain their decisions in written form based on their observations. Students can give oral presentations to the class describing their experiments and the results they found (ELA link–GCO 12.4).

Activity 18: Water and Soil

Outcome

Students will be expected to

- observe and describe the effects of moving water on different types of soil (100-39)

Assessment

- Students will describe the effects of water on soil.
- Students are able to describe how plants help to keep soil in place.
- Students are able to explain erosion and give examples of where it could be found.
- Students are able to give examples of the causes of erosion.

Questions

- What effect does water have on soil?
- How do plants help keep soil in place?
- What does erosion mean?
- How can we help prevent erosion?
- How does nature provide protection against erosion?

Materials

- an area where students can observe the effects of moving water on soil (hillside)
- videos or web sites illustrating erosion and how nature and people can help to prevent it

Procedure

This activity is based largely on observation. It may not be possible to access an area where erosion has taken place. However, you can take students out in the neighbourhood to discuss what would happen if there were no trees or grass around the soil and what effect moving water has on the soil. A trip to the ocean to observe the effects of tides on beaches and the importance of grassy areas around beaches is a worthwhile outing. Videos, reference books, and/or Internet sites could be used for research on the effects of moving water on soil. Speakers from the Department of Agriculture and Fisheries or a local farmer could be brought in to discuss the effects of moving water on soil and the impact it has on living things.

Activity 19: Moving Water and Different Types of Soil

Outcome

Students will be expected to

- observe and describe the effects of moving water on different types of soil (100-39)

Assessment

- Students are able to explain the effects of moving water on different types of soil.
- Students are able to illustrate the effects of moving water on various types of soil.

Questions

- What types of soil did you use?
- Was there a difference in the effects of moving water on the different types of soil?
- What type of soil appeared to cause the least erosion.

Materials

- aluminum cake pans—one for each type of soil (perhaps from a dollar store)
- various types of soil (clay, sand, planting soil)
- water
- metric measuring containers for water and soil

Procedure

Have the students work in groups. This activity is designed to simulate the effects of moving water on different types of soil. Students should be told to use the same amount of soil in each container. Have the students decide if the soil should be moist or dry before they try their experiment. Have them decide if the soil should be packed down or loose. They could try both ways to see if there is any difference in the effect of moving water on it. After the students have place the soil in the pans have them place them on a slope in order that the water can run down them. The slope should be the same for the different types of soil being tested. Have the students pour water on the soil and observe what happens. The same amount of water should be used on each soil sample. Have students record their observations through illustrations and written descriptions.

Have each group share its findings with the class. Discuss with students if this is a realistic way to see what effects moving water has on soil.

Moving Water and Different Types of Soil Activity Sheet

Type of soil: _____

Amount of water used: _____

Illustration of what happened:

Description of what I observed:

Activity 20: Moving Water/Soil/Plants

Outcome

Students will be expected to

- observe and describe the effects of moving water on different types of soil (100-39)

Assessment

- Students are able to explain the effects of moving water on soil when it is covered with plants.
- Students are able to illustrate the effects of moving water on various types of soil covered with plants.

Questions

- What effect did the plants have on the soil when moving water was placed on it?
- How do plants help prevent erosion?
- Does the type of soil have anything to do with the kinds of homes that are built around the world?

Materials

- aluminum cake pans—one for each type of soil
- various types of soil (clay, sand, planting soil with grass planted and growing in/on it)
- water
- metric measuring containers for water and soil

Procedure

This learning experience is designed to simulate the effects of moving water on different types of soil that has grass growing on it. Students should be given the opportunity to grow the grass in advance for this activity. Otherwise, grass and soil could be brought in. Have students place their pans on a slope. Have them pour the same amount of water on each soil sample. Have them record what they observe. Discussions can be carried out as to the difference between this activity and the one where the soil did not have plants growing on it. Students should discuss how plants help prevent erosion and how farmland and areas around oceans and hillsides are protected against erosion. Discussions could take place around what impact housing developments have on lakes/rivers and how contractors are required to protect these areas.

Moving Water/Soil/Plants Activity Sheet

Type of soil and plant: _____

Amount of water used: _____

Illustration of what happened:

Description of what I observed:

_____

_____

_____

_____

_____

_____

Activity 21: Animals Underground

Outcome

Students will be expected to

- investigate and describe how living things affect and are affected by soils (100-35)

Assessment

- Students are able to produce an example of where animals live using soil as protection and a place to live.
- Students are able to use reference materials to gain a better understanding of the animal they chose and how it lives.

Questions

- What types of animals live underground?
- How do they rely on soil to survive and protect them?

Materials

- pea gravel
- dried earth
- sawdust (to represent soil layers)
- green construction paper
- newspaper
- paper boxes (shoe boxes)
- toilet tissue rolls (cut in half length wise)
- white glue
- scissors
- brown paint (liquid tempera)
- sponges
- spoons
- water container to mix in
- little model animal(s)
- plastic insects
- plaster of Paris
- utility knife
- plastic

Procedure

Prior to doing this activity students should be given the opportunity to do research on the types of animals that live underground. From this research they can then make an example of the animal's habitat. Students may also wish to base their projection on a type of insect instead of an animal.

Remove flaps from the box. Glue scrunched-up balls of newspaper to the back of the box. Cut toilet tissue rolls lengthwise, glue the rounded sides together, then glue them in between the newsprint to create tunnels for the animal.

Mix up the plaster of Paris and spread over newspaper. Quickly press the earth materials (three different types), in layers, into the plaster of Paris. After the plaster of Paris has dried, set the box upright on its lengthwise side. Paint the outside of the box brown, using the sponge. Use green construction paper to make a row of grass on the top of the box. Add the model animal or insect.

Connections: Visual Arts GCO1—Students will explore and manipulate a range of materials, demonstrating an ability to express themselves.

Connections: English Language Arts—Have students write a description or give an oral explanation of their model, the animal/insects they have chosen, where it lives, and how living things affect and are affected by soils.

Activity 22: Living Things in Soil—Animals/Insects

Outcome

Students will be expected to

- investigate and describe how living things affect and are affected by soils (100-35)

Assessment

- Students are able to observe living things in soil and explain how they are interdependent on each other.
- Students are able to describe the role of animals and insects in providing nutrients to soil.
- Students are able to illustrate how soil is a home to many different types of animals and insects.

Questions

- How does soil help protect animals and insects?
- How do certain animals and insects use soil to provide protection for themselves?
- How do animals and insects provide nutrients to soil?
- What are some of the animals and plants that live in soil?

Materials

- soil (from outdoors or have students go out and dig up soil)
- clear jars
- commercially purchased ant farm kits (optional)
- shovels
- trowels
- rubber gloves
- activity sheet (optional)

Procedure

A lot of what can be observed first hand in this learning experience depends on the location of your school and the availability of soil that can be dug up. If these are not available, arrangements could be made to take a field trip to a local farm or area where permission has been given to dig up soil to observe living things. If this is not possible, videos, books, and in-class simulated environments could be used (an ant farm could be made, or soil could be purchased and placed in clear jars and worms placed in them to observe).

When students are digging in an area outdoors, remind them to be respectful of the living things they find. After students have observed insects in the soil, they should draw what they observed. Students should be given the opportunity to discuss what they found, where they found them, and the amount they found. These should be recorded for future reference.

Students should be given the opportunity to do research on animals/insects that live in soil and present their research to the class (English Language Arts GCO 12.4).

Living Things in Soil—Animals/Insects Activity Sheet

Illustration of my soil sample:

Illustration of what I found:

Description of what I found:

Type of soil:

Activity 23: Living Things in Soil—Plants

Outcome

Students will be expected to

- investigate and describe how living things affect and are affected by soils (100-35)

Assessment

- Students are able to describe through observation how plants rely on soil.
- Students are able to describe how roots from plants affect soil.

Questions

- How does soil help plants remain stable in the ground?
- What do plants get from the soil in order to survive?

Materials

- plants in soil (either grown or observed outdoors)
- diagrams illustrating roots from plants in soil

Procedure

In the unit on plants, students will have learned about roots and will have had the opportunity to observe roots in the soil. In this learning experience, students should be taken on a nature walk to observe various types of plants, and discussions should take place on what effect the plants have on the soil and what effect the soil has on plants. For example, discussions could revolve around the impact of hurricanes on tress and how some trees become uprooted by powerful winds while others remain stationary. Questions might include, What does the soil have to do with keeping a tree in the ground? How do the roots of some plants spread out nearer the surface while others go down further into the ground? What do the roots from plants get from the soil? (moisture, nutrients, stability)

Growing plants in clear containers will show the root system of plants. Have students draw what they think the root system of a tree looks like in soil. Have them label their diagrams. Students may ask quesitons such as Do all trees have the same root system? Do all plants have the same uses for their roots? Discuss how nutrients get into soil and help plants grow.

Activity 24: Uses of Earth Materials

Outcome

Students will be expected to

- demonstrate and describe earth materials while exploring objects made from them (101-12, 203-1)

Assessment

- Students are able to use materials from the earth to make useful objects.
- Students are able to discuss ways that earth materials can be used in a useful manner.

Questions

- Where can you gather materials to make useful objects?
- What resources could you use to locate items that are made from earth materials?

Materials

- self-hardening clay (from craft stores)
- sand
- soil to make mud bricks

Procedure

This activity is subject to the availability of materials. Students should be given the opportunity to explore, research, and create materials made from the earth. These could include sand sculptures, jewelry, mud houses, and clay art. Various types of clay are available for use from craft stores. Students could make sand sculptures with sand or sand drawings using sand, glue, and paper. Discussions surrounding respecting earth materials should be carried out.

Appendix G: Activities for Physical Science: Invisible Forces

Activity 25: Pulling Together

Outcome

Students will be expected to

- investigate to identify and group materials that can be magnetized or attracted by magnets and distinguish these from materials that are not attracted to magnets (100-31, 202-2)

Assessment

- Students are able to sort materials that are attracted by magnets and those that are not.
- Students are able to record their findings.

Questions

- Which materials were attracted to magnets?
- Which materials were not attracted to magnets?
- What characteristics did the materials attracted to the magnets have in common?
- What characteristics did the materials that were not attracted to the magnets have in common?

Materials

- bar magnets
- a variety of materials that students can use to see if they attract to magnets or not (e.g., cloth, plastic, paper, nails, paper clips, aluminum foil, pennies)
- activity sheet

Procedure

Brainstorm with students the term attraction. Write a workable definition of the term on chart paper or on the board from the students' responses.

Give the students a variety of materials to see if they are attracted to magnets or not. Have them sort them using attribute rings (attracts to magnets, does not attract to magnets). Have the students record their findings.

Discuss with students their observations. Use the questions outlined above to lead the discussions.

Pulling Together Activity Sheet

Material	Attracts to the Magnet	Does Not Attract to the Magnet

What did the objects that were attracted to the magnet have in common?

What did the objects that were not attracted to the magnet have in common?

Activity 26: Push or Pull

Outcome

Students will be expected to

- investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel (100-32)

Assessment

- Students are able to distinguish between like and unlike poles on magnets.
- Students are able to use attract and repel when discussing magnets.
- Students are able to draw magnets illustrating north and south poles, and magnets attracting and repelling.

Questions

- What does repel mean?
- What does attract mean?
- What happened when like poles on magnets were brought near each other?
- What happened when unlike poles on magnets were brought near each other?

Materials

- bar magnets with N and S labelled on them
- a variety of magnets
  - U magnets
  - wand magnets
  - ball magnets
  - ceramic magnets
  - strip magnets
- activity sheet (optional)

Procedure

Brainstorm with students the terms **attract** and **repel**. Write workable definitions from the students' responses on the board or chart paper. Give each group of students two bar magnets. Have the students explore different ways to bring the magnets together. Have students record their observations.

Discuss as a class what the students observed.

Next, give each group of students a variety of magnets. Have them observe if the magnets react the same way as the bar magnets. Discuss as a class what the students observed. Have them record their observations through illustrations with labels and/or written descriptions in their science logs or on recording sheets.

Push or Pull Activity Sheet

Diagram of bar magnets repelling each other:

Observations:

Diagram of bar magnets attracting to each other:

Observations:

Activity 27: Magnetic Field

Outcome

Students will be expected to

- investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel (100-32)

Assessment

- Students are able to observe the magnetic field of a magnet.
- Students are able to illustrate and describe the magnetic field of a magnet.

Questions

- What happened when you put iron filings over the magnet?
- How would you describe what you observed?

Materials

- bar magnets with N and S labelled on them
- a variety of magnets
  - U magnets
  - wand magnets
  - ceramic magnets
  - strip magnets (optional)
- activity sheet (optional)
- acetate sheets (overhead transparencies) taped together in pairs with iron filings in between (clear page protectors, taped shut) could also be used

Procedure

Give each group of students a bar magnet and acetate sheets with iron filings or a plain sheet of paper and iron filings. These are made using overhead transparencies or the like, by placing iron filings between two sheets and taping the ends. Have the students place the acetate sheets over the bar magnet. Have them move the sheets to disperse the iron filings. Have them record what they see.

If the students use paper and iron filings they should try not to have the iron filings go on the magnet as they are hard to remove. Discuss with the students what they observed.

Next, give each group of students a variety of magnets. Have students observe if the magnets make a magnetic field. Ask them to illustrate and/or describe what they observed.

Magnetic Field Activity Sheet

You just completed an activity using acetate sheets, iron filings, and magnets. Draw the magnetic field that you observed when the magnets repelled each other.

Observations:

Draw the magnetic field that you observed when the magnets attracted each other.

Observations:

Activity 28: Exploring Magnets

Outcome

Students will be expected to

- identify familiar uses of magnets (102-14)

Assessment

- Students will be able to distinguish between various types of magnets.
- Students will be able to identify familiar uses of magnets.

Questions

- What did the various magnets have in common?
- What differences did the magnets have?
- Where are magnets used in your home?

Materials

- a variety of magnets (ceramic, ball, wand, strip, bar, U, advertising magnets, magnetite)

Procedure

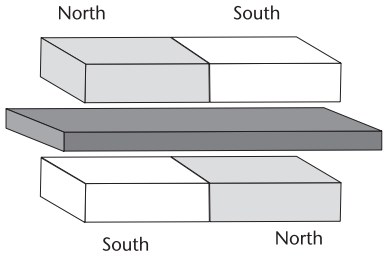
Divide the students into groups and give them a variety of magnets. Let the students explore their magnets. Have students record what they observed.

Discuss with the students what they observed. Discuss with students the proper way of storing magnets.

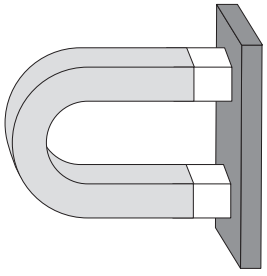
Brainstorm and record familiar uses of magnets with the students.

Proper Way to Store Magnets

Bar magnets: Opposite poles should be facing each other. A spacer should be between the two magnets.



U magnets: Metal keeper on the end.



Activity 29: Making a Magnet

Outcome

Students will be expected to

- follow procedures and identify problems related to strength of temporary magnets and to magnetizing materials (200-2, 201-1)

Assessment

- Students will be able to make their own magnets through experimentation.
- Students will be able to make a magnet stronger.
- Students are able to record the results of their experiments and explain what they did.

Questions

- How did you make a magnet?
- What types of materials did you use?
- How were you able to make a stronger magnet?

Materials

- strong magnets
- pins and/or iron nails
- staples
- activity sheet (optional)

Procedure

Review with students what they learned in the learning experience, Pulling Together (Activity 25). Ask students which materials they would use to try to make a magnet. Provide students with materials. Challenge the students to try to make their nail or pin magnetized.

Have them record how they were able to do it and any problems they might have encountered. Have students share how they made their magnets and record their methods on chart paper or on the board for future reference.

Next, discuss with students ways in which they could make their temporary magnets stronger. Tell students that they need to stroke their nails or pins in the same direction using the same end of the magnet. Have them experiment to see if the number of times they stroke the nail or pin on the magnet increases the strength of the temporary magnet. Have them record their results on the activity sheet or on a chart in their science logs.

Making a Magnet Activity Sheet

Number of Strokes	Number of Staples Picked Up

What I observed:

Activity 30: Strength of a Magnet

Outcome

Students will be expected to

- make predictions, record observations, and identify proposed questions about the number of objects that can be picked up by a magnet under different conditions (200-3, 201-5)

Assessment

- Students are able to predict and observe the impact of different conditions on the strength of a magnet.
- Students are able to convey their results both verbally and in written format.

Questions

- What did you observe happened to the ability of the magnet to pick up objects through different substances?
- What happened to the strength of the magnet when you tried to pick up objects through different materials?

Materials

- ceramic, bar, or wand magnets
- items to be picked up (paper clips, staples, finishing nails)
- various materials (cloth, wood, aluminum foil) to see if the magnetic force is affected by them
- activity sheet (optional)

Procedure

Have students predict what they think would happen to the strength of a magnet if it had to pick up objects through another material. Give students a variety of materials to see what impact they have on the strength of a magnet. For example, have the students use a magnet to see how many paper clips it can pick up. Then have them use the same magnet and hold it on a desktop and see how many paper clips it can hold through the desktop by placing the paper clips on the other side. Ask students to share their ideas, and have the class try them out. Have students record their findings.

Discuss as a class what they observed and any questions that may have arisen as a result of this experiment.

Strength of a Magnet Activity Sheet

Type of Magnet	Type of Material	Object Picked Up	Number of the Object Picked up by the Magnet	Number of the Object Picked up by the Magnet through the Material

What I observed:

Activity 31: Magnetism and Water

Outcomes

Students will be expected to

- make predictions, record observations, and identify proposed questions about the number of objects that can be picked up by a magnet under different conditions (200-3, 201-5)

Assessment

- Students are able to design an investigation to see if the magnetic field of a magnet is able to pass through water.
- Students are able to observe and record their findings.
- Students are able to predict what might happen if other liquids are used.

Questions

- How are you going to design your investigation?
- What did your investigation show you about how the magnetic field of a magnet reacted to water?
- What did you observe about the magnetic field and other liquids?

Materials

- wand magnets
- clear plastic cups
- water and other liquids (vegetable oil, vinegar, syrup, molasses)
- paper clips
- measuring cups

Procedure

Review with your students what they have learned about the strength of a magnet. Explain to the students that they are going to design an investigation to see if the magnetic field of a magnet is able to go through water.

Give each group time to design the step-by-step process they are going to use. Remind students of fair test principles. This provides a great opportunity to use capacity connection in math. Give the students the materials they need and have them carry out their investigations.

Discuss with students what they observed and how magnets might be used in society. Have them try other liquids to see if they come up with similar results. Draw attention to the density of a liquid and the effect it might have on the magnetic field of a magnet. Students may understand the thickness, flow, and volume of a liquid more than the term **density**. Density is studied in depth in Science 8.

Magnetism and Water Activity Sheet

1. Steps for our investigation:

2. What we found out from our investigation with water and a magnet (explanation and drawing):

Activity 32: Using Magnetism

Outcome

Students will be expected to

- construct and evaluate a toy that is moved by magnetic forces (201-3, 202-8)

Assessment

- Students are able to use their knowledge of magnetism to make a toy or game.

Question

- How could you use the properties of magnetism that you have learned to build a toy or game?

Materials

- various types of magnets
- materials students need to build a toy or game

Procedure

Ask students to use the magnets provided to build a toy or game using various materials. Some suggestions might be a hockey game (where the players have washers as their base and a magnet is used to move them), golf (where the golfer is set on a washer and a magnet is used to push the golfer into the ball to make it go in a hole) or a car that moves by magnets.

Have students make drawings of their games/toys and do a brief write-up explaining how they made it, problems encountered, how they solved the problems, and how the game/toy works.

Students should be given the opportunity to share their ideas with the class.

Activity 33: Static Electricity—Attract/Repel

Outcome

Students will be expected to

- demonstrate and describe ways to use everyday materials to produce static electric charges and describe how charged materials interact (101-8)

Assessment

- Students are able to demonstrate materials attracting and repelling each other.
- Students are able to illustrate and explain what happened when objects attract or repel each other.

Questions

- What happened when a statically charged material came in contact with another object (piece of material)?
- Do the materials react the same way each time? Tell what happened.

Materials

- a variety of materials (cotton, wool, polyester, plastic, wood, aluminum foil)
- straws
- puffed rice
- pith balls
- string

Procedure

Hang puffed rice or pith balls by string over the edge of a desk. Give each group of students a variety of materials and a straw. Have the students rub the material against the straw and move the straw towards the hanging puffed rice or pith ball. Have them observe and record what they observed. After the students have completed the activity, discuss with them their results.

This water activity can be either teacher demonstrated or sent home to complete. Run a slow stream of water from a water tap. Bring a statically charged object close to it. Watch how the water moves.

Static Electricity—Attract/Repel Activity Sheet

Type of Material	Attracts the Puffed Rice or Pith Ball	Attracts the Puffed Rice or Pith Ball

Description and illustration of one of the investigations.

Activity 34: What Is Static Electricity?

Outcome

Students will be expected to

- demonstrate and describe ways to use everyday materials to produce static electric charges and describe how charged materials interact (101-8)

Assessment

- Students are able to demonstrate static electricity.
- Students are able to give examples of where static electricity can be found.

Questions

- What happened to the balloon when you rubbed it on your hair and placed it on a wall?
- What materials create static electric charges?

Materials

- balloons
- a variety of cloth
- straws
- plastic

Procedure

Brainstorm with students what they think the term "static electric charges" means. Have them give examples of where they have seen or felt static electricity. Give the students a variety of materials and have them try to create static electric charges; for example, rubbing a balloon on their hair and having it stick to the wall. Do students know any other methods? Illustrate and record findings.

Discuss with the students how they knew they had created a static electric charge.

Activity 35: Zap-light and Static Electricity

Outcome

Students will be expected to

- demonstrate and describe ways to use everyday materials to produce static electric charges and describe how charged materials interact (101-8)

Assessment

- Students are able to describe what happens when a statically charged material comes in contact with a fluorescent light bulb.

Questions

- What did you notice happened to the fluorescent light bulb when a statically charged material came in contact with it?
- What do you think might have happened to cause this reaction?

Materials

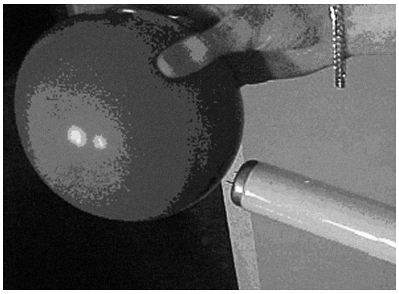
- fluorescent light bulb (not an incandescent bulb)
- a darkened room
- balloon

Procedure

This is a teacher-demonstrated activity.

In a darkened room, build up a static charge on a balloon by rubbing it on a piece of clothing or on your hair. Bring the balloon in contact with the metal end of the fluorescent light bulb. Observe what happens.

Explanation (**teacher use**): When the charged balloon touches the metal end of the fluorescent light bulb, electrons move from the balloon to the bulb causing sparks of light inside. Normally the electrons move to light the bulb from the electrical power lines through a wire in the end of the tube.



Activity 36: The Strength of Static Electricity

Outcome

Students will be expected to

- iidentify and investigate conditions that affect the force of magnets and of static electric materials (100-33, 202-7)

Assessment

- Students are able to determine if a static charge is able to go through various materials.
- Students are able to see if the type of material or the thickness of the material affects the strength of the static charge.

Questions

- What effect did the thickness of the material have on the strength of the static charge?
- Was a static charge able to attract or repel objects through various materials?

Materials

- paper
- ticket board
- wood (desk top)
- aluminum foil
- balloons
- straws
- various types of material (cloth, plastic, paper)
- puffed rice
- clear plastic cup
- water

Procedure

Discuss with students whether they think a static charge is able to go through an object/substance. Ask students how they would go about investigating their ideas. Put their suggestions for investigations on the board or chart paper. Give the students a balloon, straw, and materials to carry out their investigations.

Example: Have students put a piece of string or puffed rice on a sheet of paper. Put the charged material under the paper. Are you able to move the puffed rice or string as they move the charged object. Record the results.

Next, have students see if a static charge is able to pass through water. Let students share their observations.

The Strength of Static Electricity Activity Sheet

Material to See if a Static Charge Will Pass through It	Charged Object	Moves the Object	Doesn't Move the Object

1. Was a static charge able to pass through some materials? How do you know?

2. Diagram of one of the investigations:

Activity 37: Effects of Static Electricity

Outcome

Students will be expected to

- identify questions and describe examples of the effects of static electricity in their daily lives and ways in which it can be used safely or avoided (102-15)

Assessment

- Students are able to use their knowledge and experience with static electricity to discuss ways in which static electricity can be avoided in daily life.
- Students are able to write a commercial for a product that helps prevent static electricity.

Questions

- What products have you seen advertised or observed being used around your home to help prevent static electricity?
- How does your commercial promote the need to eliminate static electricity?

Materials

- various products that are used to prevent static electricity

Procedure

Ask students where they have seen a need to reduce or eliminate static electricity around their house (walking on a carpet and touching a door knob, clothes from a dryer, etc.). Ask students to give examples of products their families use or ways in which the static electricity has been eliminated. Bring in products and demonstrate their usefulness to the class.

Discuss with students various types of commercials (advertisements from magazines, television commercials, billboard advertisements, etc.). Have them indicate what parts are appealing to them. Have them either make an advertisement for an already existing product or have them design an imaginary or real product to reduce or eliminate static electricity and an advertisement to promote it. Have students share their advertisements with the class.

Activity 38: Static Electricity—What I Have Learned

Outcome

Students will be expected to

- identify questions and describe examples of the effects of static electricity in their daily lives and ways in which it can be used safely or avoided (102-15)

Assessment

- Students are able to use their knowledge and experience with static electricity to identify new questions.

Questions

- as developed by students
- Have you ever felt static electricity around a vehicle?

Materials

- none

Procedure

Discuss with students what they have learned about static electricity. Have students review where they have observed static electricity in real-life situations. Write their comments on chart paper or on the board. Have them ask questions that still need to be answered. These questions could be used in examining the outcome 102-15. Examples of questions that students might ask are, What happens to clothes when they are still warm and you take them out of the dryer? Do clothes have the same reaction after they have cooled down? Does hanging clothes on the clothesline have a different effect on the amount of static electricity compared to drying them in a dryer? What happens when you walk across a carpet and touch a metal object? Is there a difference in the reaction if you walk on hardwood or laminate floors? Does what you have on your feet make a difference?

After students have posed various questions, use outcome 102-15 as a means to find answers to these questions.

Appendix H: Activities for Physical Science: Materials and Structures

Activity 39: Getting Started—The Tower

Outcome

Students will be expected to

- identify problems to be solved while creating structures (200-2)

Assessment

- Students are able to recognize problem-solving strategies while designing their structures.
- Students are able to record their design process.
- Students are able to record problems they encountered and how they solved them.

Questions

- What strategies did you use to design your tower?
- How did you come to consensus as a group on how to build your tower?
- What problems did you encounter and how were you able to solve them?

Materials

- straws
- clay
- glue
- pipe cleaners
- paper clips
- mini marshmallows

Procedure

Discuss with the students the terms strategy, problem solving, and consensus. Put working definitions on chart paper for future reference. Pose the following problem: You are engineers who have been given the task to design and build a three-dimensional tower that is 1 m tall and is free standing. The materials you use to hold the straws together to build your tower may be marshmallows, pipe cleaners, glue, paper clips, or clay.

Task 1: With students working in groups of no more than three have them decide what materials they are going to use.

Task 2: Have students illustrate the design of their towers on paper.

Task 3: Have students discuss and record problems they might encounter and how they would solve them.

Task 4: Have students build their towers and record problems they encountered and how they solved them.

Task 5: Have students use a digital camera to take pictures of their towers. Students may also wish to use a video camera to record the building of their towers.

Task 6: Have students take their notes from steps 1–4 and put them in a form to present to the class (oral, written, charts).

Task 7: Have students share their towers with the rest of the class and discuss the problems they encountered and how they solved them.

Getting Started—The Tower Activity Sheet

<table>
<tr><td>My Group:</td><td>Materials we are going to use to make our tower:</td></tr>
<tr><td rowspan="2">Illustration of the design of our tower:</td><td>Observations:</td></tr>
<tr><td>Problems we might encounter:</td></tr>
</table>

Getting Started—The Tower Activity Sheet (Part 2)

Illustration of the tower we were able to make:	Changes we had to make to our original design:
	Problems we encountered:
Strategies we used to try to solve any problems:	

Activity 40: Use of Materials

Outcome

Students will be expected to

- describe, evaluate, and investigate common materials, their suitability for use in building structures, and ways to join materials together (100-34, 101-11)

Assessment

- Students are able to evaluate the appropriateness of various materials for building structures.
- Students are able to identify various types of materials and where they might be used or what might use them to build structures.
- Students are able to manipulate materials to make them sturdier.

Questions

- What are the names of the various materials?
- How would you use the materials to make a structure?
- Who or what might use the various materials?
- What could you do to a material to make it stronger or sturdier?

Materials

- an assortment of materials which could include the following:
  - Popsicle sticks
  - pieces of wood
  - cotton balls
  - toothpicks
  - straws
  - newspaper
  - pipe cleaners
- activity chart (optional)

Procedure

Give each group of students a variety of materials. Ask students to describe and name the materials and then decide what types of objects could be built with the materials. Next, have students think about how they might be used and who or what might use them. Prompt the students to investigate how to make the materials more sturdy.

Ask, “How would you be able to make paper stronger?” Have students try their ideas. This can be related to how animals adapt materials to make them useful to them.

Teacher Note: The newspaper could be used later in this unit to build geometric figures in the activity Geometric Figures.

Use of Materials Activity Sheet

Material _____ The type of structure it would be suitable for:	Material _____ The type of structure it would be suitable for:
Material _____ The type of structure it would be suitable for:	Material _____ The type of structure it would be suitable for:

Activity 41: My Fasteners and Their Uses

Outcome

Students will be expected to

- describe, evaluate, and investigate common materials, their suitability for use in building structures, and ways to join materials together (100-34, 101-11)

Assessment

- Students are able to sort a variety of fasteners by how or where they would be used.
- Students are able to identify and record uses of a variety of fasteners.

Questions

- What sorting rule(s) did you use to sort the various types of fasteners?
- How do we use a variety of fasteners in the world around us?
- Where would you use the fasteners you explored in this lesson?

Materials

- a variety of fasteners
- various types of glue
- paperclips
- bulldog clips
- brass fasteners
- Velcro
- snaps
- thread
- string
- rope
- twine
- a variety of screws
- a variety of nails
- needles
- safety pins

Procedure

Give the students a variety of fasteners to sort by material, by use, and/or by shape. Discuss with students their sorting rule(s)—all metal fasteners together or sorted by use or shape or their choice. Put the name of each fastener on the board or chart paper for future reference. Now have the students sort the fasteners by their use.

Have students fill in the recording sheet or have them make one of their own, indicating the name of the fastener and its use.

My Fasteners and Their Uses Activity Sheet

Fastener	Use

I think we have so many different types of fasteners because

Activity 42: Using My Fasteners

Outcome

Students will be expected to

- describe, evaluate, and investigate common materials, their suitability for use in building structures, and ways to join materials together (100-34, 101-11)

Assessment

- Students are able to demonstrate the use of a variety of fasteners.

Questions

- How does the strength of a paper clip in holding a quantity of paper compare to that of a bulldog clip?
- How does a snap work in comparison to Velcro?

Materials

- a variety of fasteners
- various types of glue
- paperclips
- bulldog clips
- brass fasteners
- Velcro, snaps
- thread
- string
- rope
- twine
- a variety of screws
- a variety of nails
- needles
- safety pins
- hammers
- screwdrivers
- staples
- stapler
- sewing needles
- blocks of wood
- cloth
- hammers
- screwdrivers

Procedure

It will probably take several science periods to complete this learning experience. It could be done in a centres approach. Students may need to explore the materials.

Review with students what they learned from the previous activity, My Fasteners and Their Uses. Indicate that this lesson will provide them hands-on experiences to explore how and where their fasteners can be used.

As they are exploring the various fasteners, have them record what they learned, problems they encountered, and how they solved them. These experiences should be discussed as a class on completion of the lesson.

Using My Fasteners Activity Sheet

Fastener	What I Learned, Problems I Encountered, and How I Solved Them

Activity 43: Bonding Materials—Testing Glue

Outcome

Students will be expected to

- describe, evaluate, and investigate common materials, their suitability for use in building structures, and ways to join materials together (100-34, 101-11)

Assessment

- Students are able to discuss the uses of glue and record their discussions.
- Students are able to make their own glue.
- Students are able to investigate the materials their glue will bond to.

Questions

- What are common uses of glue?
- What types of glue have you or your family used and what have they been used for?
- What types of materials did the glue you made hold together?
- How does your glue compare to kinds you purchase in the store?

Materials

- glue
- cornstarch
- water
- pot
- hot plate
- measuring cups
- spoons
- a variety of materials (paper, cloth, wood) to test the glue

Procedure

This activity will take at least two science periods. You will need one period to make the glue and the second to do the testing of its bonding ability.

In groups have students discuss the various types of glue they have used. Have them record their discussions on paper. Have students share the various types of glue and their uses with the class. Make a master list on chart paper and have students record them in their science logs.

Tell students that they are going to make their own glue. Have students work in groups.

Caution: If you are going to make glue, students will need to be supervised as the boiling water can be dangerous.

Directions for Glue

Mix 45 mL cornstarch with 60 mL of cold water in a small container (250 mL)

Boil 500 mL of water in a pot

Pour the cornstarch and cold water mixture into the boiling water and stir until it thickens.

Carefully pour the thickened glue into a 250-mL or 500-mL plastic container. Allow to cool.

Bonding Materials Activity Sheet

Material	Type of Glue	Bonded	Didn't Bond

What I observed about my glue:

Activity 44: Structures and Shapes

Outcomes

Students will be expected to

- identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance (102-16)

Assessment

- Students are able to identify various geometric shapes in both natural and human-built environments.
- Students are able to identify shapes that would provide stability, strength, or balance through exploration.
- Students are able to illustrate and record their findings from the explorations carried out.

Questions

- How do animals use stability, strength, or balance in building their structures?
- What and where were you able to find shapes in human-built structures within your community?
- What geometric shapes would you use if you were building a tower?

Materials

- pictures of towers (these can be found using the Internet or in books)
- pictures of various structures built by animals (these can be found using the Internet or in books)

Procedure

Take the students on a walk around the community. Have them record structures that they see and make notes on what they think makes them strong, stable, or balanced. Have students record any geometric shapes they might see that are used to make the structure strong, stable, or balanced.

As a class discuss what the students observed. Have pictures of structures made by animals or by humans available for students to discuss and explore. Ask students to record their observations and discuss as a class.

Activity 45: Bridges

Outcomes

Students will be expected to

- identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance (102-16)
- identify materials that could be used to solve the problem posed and suggest a plan for how they will be used through oral, written, and/or illustrated responses (200-5, 203-3)

Assessment

- Students are able to identify the characteristics of various types of bridges.
- Students are able to determine the types of materials appropriate to make models of bridges.
- Students are able to develop solutions to problems encountered when designing and building models of bridges.
- Students are able to design and build models of various types bridges.

Questions

- What are some of the types of bridges used in the world?
- What types of materials are used to make bridges?
- How does the design of the bridge relate to the area or terrain it has to span?
- What difficulties did you have in designing and constructing your bridge?
- What problem-solving strategies did you use to solve the challenges your bridge posed?

Materials

- pictures of bridges
- books on bridges
- materials to build a box girder bridge (paper, ticket board, construction paper, glue, scissors blocks of wood, or books)

Procedure

There are several parts to a science activity. It may take several science periods to do.

Part 1: If there are bridges in your community take students for a walk to see them. Have students record their observations of how they are made, what they are made of, their stability and structure. Have them draw a sketch of the bridge(s).

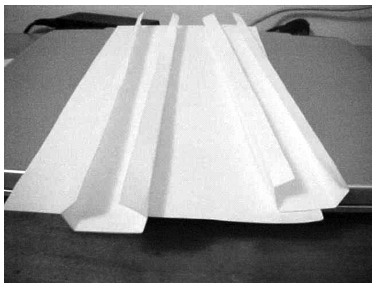
Websites that show examples and explanations of various bridges can be found on the Department website at <EDnet.ns.ca> by following the these links: Educators > Classroom & Curriculum Resources > Curriculum-related web sites > Science > Science 3.

Show students various types of bridges and discuss where they have been built.

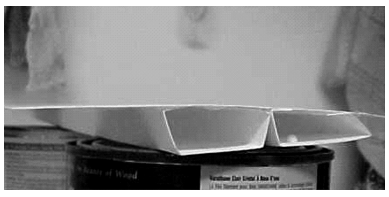
Part 2: Have students build a box girder bridge using the following directions. Prior to building the bridge have students predict what will happen to the strength of the materials being used as their shape is changed. Have students use the materials to make a bridge before making the box girder bridge. Have them record their observations.

Directions:

- cut two pieces of ticket board or construction paper to the dimensions of 15 cm by 45 cm
- cut one piece of the 15 cm by 45 cm ticket board/construction paper in half, length-wise
- fold each of the two strips twice on each side by 1 cm per fold



- glue the two folded strips to one side of the remaining 15 cm by 45 cm strip



- stand the books or blocks of wood or other supporting material upright and place the beams across them.

Part 3: Have students record the difference in the strength of the ticket board/construction paper before they were made into a box girder and after. Students may wish to see how many objects their bridge can hold.

Activity 46: Building a Bridge Challenge—The Design

Outcomes

Students will be expected to

- identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance (102-16)
- identify materials that could be used to solve the problem posed and suggest a plan for how they will be used through oral, written, and/or illustrated responses (200-5, 203-3)

Assessment

- Students are able to draw a rough sketch of the bridge they are going to build.
- Students are able to create a list of materials they will need to build their bridge.

Questions

- How did your group decide on which type of bridge you were going to design and make?
- What did you decide to use?
- What did you base your decision on?

Materials

- pictures of bridges
- books on bridges
- rulers and paper to sketch their bridge

Procedure

Review with students the work they have already completed over the past weeks on problem-solving strategies, shapes of objects, materials to hold objects together, and so on.

Tell the students that they are going to begin their own challenge by designing a bridge that will expand a distance of no less than 60 cm and it must be able to hold a small car/truck ("matchbox" size). Students are to work in groups. The first part of the process is to decide what type of bridge they are going to build and then make a sketch of it.

The second part of the challenge is to decide what materials they are going to use to build their bridge. Materials may include string, twine, stir sticks, toothpicks, straws, glue, nails, paper, construction paper, ticket board, scissors. Have the students record what they need along with the type of bridge they are building and a sketch of the bridge.

Building a Bridge Challenge—The Design Activity Sheet

Sketch of our bridge:

Materials we will need to build our bridge:

Activity 47: Building the Bridge Challenge

Outcomes

Students will be expected to

- safely use and follow safety procedures while using appropriate tools and materials to construct structures (101-10, 201-3, 201-8)
- manipulate materials and respond to the ideas of others to make changes in creating structures as deemed necessary (201-2, 203-5)

Assessment

- Students are able to make their structures from the designs and materials they selected from the activity Building a Bridge.
- Students are able to work co-operatively with partners to build their structures.
- Students are able to use tools purposefully to build their structures.
- Students are able to make changes in the design of their structures as deemed necessary.

Questions

- What strategies did you use to build your structure?
- What tools and materials did you need to complete your task?
- How did working with a partner support you in the building of your structure? Were there any difficulties you encountered in working with a partner? If so, tell about them and how you solved your problems.

Materials

- sketches and notes from the activity Building a Bridge Challenge—The Design
- materials to build the bridges (straws, stir sticks, glue, scissors, tape, paper, ticket board, construction paper, etc.)

Procedure

This activity may take longer than one science period. Space should be made available for students to store their bridges. Review with students the designs they developed from the learning experience, Building a Bridge. Discuss with them that during this part of the design process it continues to be important for partners to be responsible for their share of the work and to work co-operatively.

Have students build their bridges. Remind students that they should record any changes they make in their design and the reason for the changes.

Building the Bridge Challenge Activity Sheet

Changes we made in the design of our bridge:

Reasons for the changes in the design of our bridge:

New sketch of our bridge illustrating any changes that were made:

Activity 48: Geometric Figures

Outcomes

Students will be expected to

- safely use and follow safety procedures while using appropriate tools and materials to construct structures (101-10, 201-3, 201-8)
- manipulate materials and respond to the ideas of others to make changes in creating structures as deemed necessary (201-2, 203-5)

Assessment

- Students are able to use materials to create a sturdy figure.
- Students are able to name the geometric figure they built.
- Students share ideas to support the understanding and problem solving in building structures.

Questions

- What did you find was the best way in holding together your newspaper rolls?
- What effect did putting a covering over the geometric figure have in strengthening it?
- What caused the newspaper to become stronger when it was rolled?

Materials

- newspaper
- masking tape
- glue
- straws
- tissue paper
- wrapping paper

Procedure

The foundation for this activity was developed in the activity Use of Materials (page 159). Have students roll newspaper using a straw to help start the rolling process. Have examples of three-dimensional geometric solids for students to examine. Have students build the geometric solid(s) they chose. Ask students to decide what is the best way to hold the newspaper rolls together at the vertices. After students have completed their figures examine to find how sturdy they are. Discuss with them the idea of covering their figure. Pose the question, “Will this make your geometric figure more sturdy?” After they have written down their ideas, have them cover their figures. These will make nice displays for the classroom or school. Label the type of geometric solid built.

Discuss with students how structures are made more sturdy in the world around them.

Activity 49: Our Bridge—The Final Structure

Outcomes

Students will be expected to

- test the strength and stability of a personally built structure, identify ways to increase its strength, stability, form, and structure, and identify parts of the structure that failed (101-9, 202-8)
- evaluate simple structures to determine if they are effective and safe, if they make efficient use of materials, and if they are appropriate to the user and the environment (102-17)

Assessment

- Students are able to demonstrate their final structure to the class.
- Students are able to present changes they made in their design and explain the reasons for the changes.
- Students are able to demonstrate that their bridge is free standing for a distance of at least 60 cm and is able to support a small toy car/truck (criteria of the original design task in the activity "Building a Bridge Challenge—The Design").

Questions

- Allow students to ask questions as each group presents their bridge.
- What shapes did you use to make your design more suitable?

Materials

- the bridge and notes that students made

Procedure

Each group should be given the opportunity to demonstrate their bridge. They should include in their presentation their original design, materials they used, problems they encountered, and how they solved these problems. The presentations may be videotaped and played back to other classes. Digital pictures could also be taken.

After the presentations are completed, discussions should take place around real-world situations where companies design new products and the processes they must go through before they have a final working product.

Activity 50: A Building Challenge

Outcomes

Students will be expected to

- identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance (102-16)
- identify materials that could be used to solve the problem posed and suggest a plan for how they will be used through oral, written, and/or illustrated responses (200-5, 203-3)
- safely use and follow safety procedures while using appropriate tools and materials to construct structures (101-10, 201-3, 201-8)
- manipulate materials and respond to the ideas of others to make changes in creating structures as deemed necessary (201-2, 203-5)
- test the strength and stability of a personally built structure, identify ways to increase its strength, stability, form, and structure, and identify parts of the structure that failed (202-8, 101-9)
- evaluate simple structures to determine if they are effective and safe, if they make efficient use of materials, and if they are appropriate to the user and the environment (102-17)

Assessment

- Students are able to decide on a structure they would like to build.
- Students are able to follow their design and make improvements, as necessary.
- Students are able to decide on the materials needed to make their structure.

Questions

- How will you decide on the structure you want to build?
- What materials will you need to build your strucutre?
- What steps will you follow to make your structure?
- What steps will you use to solve any problems that might arise?

Materials

- books for students to use as references to decide on the structure they want to build

Procedure

This activity could be used after the students have completed the building, designing, and presenting activities on bridges. In this activity, students are to decide on their own structure and following the design process as indicated from the outcomes above and suggestions in the guide. Materials and time must be provided in order for the students to meet with success.

Appendix I: Print Resources

Authorized Learning Resources

The following resources to support teaching and learning in science are currently available through the Nova Scotia School Book Bureau. The NSSBB number is given in parenthesis. For more details, visit the website at <https://w3apps.EDnet.ns.ca/nssbb>.

Ahmed and the Nest of Sand: A Piping Plover's Story (13067)

Alphakids, Complete Set, Levels 1–11 (fiction and non-fiction) (13417), 12–24 (13418)

Bones! The Frame Inside You (16801)

Buildings That Go Up, Up, Up (16803)

Factivity Series, various titles and big books (13745, 13752, 13755, 13759, 13776)

Growing a Plant: A Journal (16804)

Is That a Fact? (13145)

Name That Plant (16802)

National Geographic: Windows on Literacy, Fluent Plus (13610)

National Geographic: Windows on Literacy, Fluent Plus Classroom Set (13646)

Pan-Canadian Science Place, Complete Grade Three Unit (13929)

PM Maths: Numeracy and Literacy, Stage C (13898), *Stage D* (13899)

Shifting Sands (13841)

The Greedy Triangle (16569)

Big Books

Amazing Animals (13341)

Animals around the World (13504)

Be a Plant Scientist (13352)

Food Alphabet (13350)

Homes Everywhere (13581)

How to Grow a Sunflower (13346)

Lifecycles (13751)

Red Leaf, Yellow Leaf (13471)

The Underground Dance (13349)

This Is Our World (13791)

Touch the Earth (13467)

What Do I Eat? (13342)

Whose Baby? (13344)

Materials

Animals and Creatures, Lego Dacta (12378)

Buildings and Structures, Lego Dacta (12424)

Community and Transportation, Lego Dacta (12435)

Early Simple Machines Kit, Lego Dacta (12446)

Software

Community Construction Kit, Mac/Win CD (51201)

Other Print Resources

This appendix contains resources that are currently *not listed* on the *Authorized Learning Resource* list that teachers may wish to access to support their science curriculum for grade 3.Where possible, an ISBN number is included to aid in locating a title. Many of the titles are trade books available through Canadian publishers and educational distributors and can more than likely be found in publishers' catalogues. They can be found as part of classroom sets of individual titles or guided reading packs. Many of these titles would be ideal for use during independent reading time in English language arts or as short read-alouds by the teacher. Some titles provide a math link for many science activities in appendices E–H that could be used during math time prior to an upcoming science lesson. Big books are listed in this appendix under a separate heading.

Anton, William. (1999). *Corn: From Farm to Table*. New York: Newbridge Educational Publishing. ISBN: 1567844685

Arnold, Tim. (2002). *Scraping the Sky*. Barrington, IL: Rigby. ISBN: 0757819907

Byrne, David. (1998). *Everyday Forces*. Barrington, IL: Rigby. ISBN: 0763523607

Economos, Christine. (1999). *City Buildings*. New York: Newbridge Educational Publishing. ISBN: 1567844804

Giesecke, Ernestine. (1999). *Forest Plants*. Chicago, IL: Heinemann. ISBN: 140340528X (Other titles in this series by various authors include *Pond Plants*, *Desert Plants*, *Flowers*, *Fruits and Seeds*, *How Plants Grow*, *Plants and Us*, *River Plants*, *Seashore Plants*, *Strange Plants* and *Wetland Plants.*)

Glover, David. (1998). *Dictionary of Science Words*. Barrington, IL: Rigby. ISBN: 0763523623

Helbrough, Emma. (2003). *How Flowers Grow*. London, UK: Usbourne Publishing Ltd. ISBN: 0794503829

Heller, Ruth. (1983). *The Reason for a Flower*. New York: Scholastic. ISBN: 0590412523

Kalman, Bobbie. (1997). *How a Plant Grows*. New York: Crabtree Publishing Company. ISBN: 0865057281

Kaner, Etta. (1994). *Bridges*. Toronto, ON: Kids Can Press. ISBN: 1550741462

Llewellyn, Claire. (2000). *Peanuts*. Barrington, IL: ISBN: 0763560936

McCormick, Rosie. (2002). *Linking Art to the World around Us: Arty Facts, Plants and Art Activities*. New York: Crabtree Publishing Company. ISBN: 0778711382 (Other titles in this series by various authors include *Structures, Materials and Art Activities*, *Planet Earth, Animals*, *Insects and Bugs*, *Oceans*, *Weather and Machines*, and *Transportation.*)

Meyers, Susan. (2002). *From Earth to Art.* Barrington, IL: Rigby. ISBN: 0757820115

Oxlade, Chris. (2002). *Soil*. Chicago, IL: Heinemann. ISBN: 1403400881

Palazzolo, Lisa. (2002). *You Couldn't Pay Me Enough to Do This Job!* Barrington, IL: Rigby. ISBN: 0757820050

Ring, Susan. (1999). *Bridges*. New York: Newbridge Educational Publishing. ISBN: 1582730172

Royston, Angela. (2002). *Forces and Motion*. Chicago, IL: Heinemann. ISBN: 1403400423

Royston, Angela. (2002). *Magnets*. Chicago, IL: Heinemann ISBN: 1403400423

Royston, Angela. (2002). *Plants and Us*. Chicago, IL: Heinemann ISBN: 1588104575

Rushby, Pamela. (2000). *Towers*. Barrington, IL: Rigby. ISBN: 0763561266

Spilsbury, Louise & Richard. (2003). *Plant Products*. Chicago, IL: Heinemann. ISBN: 1403405050 (Other titles in this series by various authors include *Plant Classification*, *Plant Growth*, *Plant Habitats*, *Plant Parts*, and *Plant Reproduction*.)

Stewart, Melissa. (2002). *Soil*. Chicago, IL: Heinemann. ISBN: 1403400962

Stradling, Jan. (2000). *Building for a Purpose*. Denver, CO: Shortland Publications. ISBN: 0769912257 (available through Wright Group)

Stradling, Jan. (2000). *Earth Materials*. Denver, CO: Shortland Publications. ISBN: 0769912303 (available through Wright Group)

Stradling, Jan. (2000). *Plants All around Us*. Denver, CO: Shortland Publications. ISBN: 0769912184 (available through Wright Group)

Stradling, Jan. (2000). *Why Things Move*. Denver, CO: Shortland Publications. ISBN: 0769912222 (available through Wright Group)

Whitehouse, Patricia. (2004). *What Can Build?* Chicago, IL: Heinemann. ISBN: 1403443777

Windsor, Jo. (2001). *Worm Work*. Barrington, IL: Rigby. ISBN: 0757818781

Appendix J: Pan-Canadian Outcomes Chart

The following outcomes from *Common Framework of Science Learning Outcomes K to 12* were used as guidelines for this science document. Column one outcomes have been developed from these pan-Canadian outcomes.

Life Science: Plant Growth and Changes

STSE/Knowledge	Skills
Students will be expected to	*Students will be expected to*
100-28 identify and describe parts of plants and their general function	**Initiating and Planning**
100-29 identify and investigate life needs of plants and describe how plants are affected by the conditions in which they grow	**200-1** ask questions that lead to exploration and investigation
100-30 observe and describe changes that occur through the life cycle of a flowering plant	**200-3** make predictions, based on an observed pattern
102-12 describe ways in which plants are important to living things and the environment	**Performing and Recording**
102-13 identify parts of different plants that provide humans with useful products, and describe the preparation that is required to obtain these products and how our supply of useful plants is replenished	**201-5** make and record relevant observations and measurements, using written language, pictures, and charts
	201-6 estimate measurements
	201-8 follow given safety procedures and rules and explain why they are needed
	Analysing and Interpreting
	202-4 construct and label concrete-object graphs, pictographs, or bar graphs
	202-5 identify and suggest explanations for patterns and discrepancies in observed objects and events
	202-6 distinguish between useful and not useful information when answering a science question
	Communication and Teamwork
	203-2 identify common objects and events, using terminology and language that others understand
	203-5 respond to the ideas and actions of others and acknowledge their ideas and contributions

Earth and Space Science: Exploring Soils

STSE/Knowledge

Students will be expected to

100-35 investigate and describe how living things affect and are affected by soils

100-36 explore and describe a variety of soils and find similarities and differences among them

100-37 investigate and describe soil components

100-38 compare the absorption of water by different soils, and describe the effect of moisture on characteristics of the soils

100-39 observe and describe the effects of moving water on different soils

101-12 demonstrate and describe ways of using earth materials to make useful objects

Skills

Students will be expected to

Initiating and Planning

200-1 ask questions that lead to exploration and investigation

200-3 make predictions, based on an observed pattern

Performing and Recording

201-3 use appropriate tools for manipulating and observing materials and in building simple models

201-5 make and record relevant observations and measurements, using written language, pictures, and charts

201-7 identify and use a variety of sources of science information and ideas

Analysing and Interpreting

202-2 place materials and objects in a sequence or in groups according to one or more attributes

202-4 construct and label concrete-object graphs, pictographs, or bar graphs

202-7 propose an answer to an initial question or problem and draw simple conclusions based on observations or research

Communication and Teamwork

203-1 communicate questions, ideas, and intentions while conducting their explorations

203-3 communicate procedures and results, using drawings, demonstrations, and written and oral descriptions

Physical Science: Invisible Forces

STSE/Knowledge	Skills
Students will be expected to	*Students will be expected to*
100-31 investigate to identify materials that can be magnetized and materials that are attracted by magnets and distinguish these from materials that are not affected by magnets	**Initiating and Planning** **200-2** identify problems to be solved
100-32 investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel	**200-3** make predictions, based on an observed pattern
100-33 identify conditions that affect the force of magnets and of static electric materials	**200-5** identify materials and suggest a plan for how they will be used
101-8 describe and demonstrate ways to use everyday materials to produce static electric charges and describe how charged materials interact	**Performing and Recording** **201-1** follow a simple procedure where instructions are given one step at a time
102-14 identify familiar uses of magnets	**201-5** make and record relevant observations and measurements, using written language, pictures, and charts
102-15 describe examples of the effects of static electricity in their daily lives and identify ways in which static electricity can be used safely or avoided	**Analysing and Interpreting** **202-2** place materials and objects in a sequence or in groups according to one or more attributes
	202-7 propose an answer to an initial question or problem and draw simple conclusions based on observations or research
	202-8 compare and evaluate personally constructed objects with respect to their form and function
	202-9 identify new questions that arise from what was learned
	Communication and Teamwork **203-3** communicate procedures and results, using drawings, demonstrations, and written and oral descriptions
	203-5 respond to the ideas and actions of others and acknowledge their ideas and contributions

Physical Science: Materials and Structures

STSE/Knowledge

Students will be expected to

100-34 describe the properties of some common materials and evaluate their suitability for use in building structures

101-9 test the strength and stability of personally built structures, and identify ways of modifying a structure to increase its strength and stability

101-10 use appropriate tools in safely cutting, shaping, making holes through, and assembling materials

101-11 investigate ways to join materials and identify the most appropriate methods for the materials to be joined

102-16 identify shapes that are part of natural and human-built structures and describe ways in which these shapes help provide strength, stability, or balance

102-17 evaluate simple structures to determine if they are effective and safe, if they make efficient use of materials, and if they are appropriate to the user and the environment

Skills

Students will be expected to

Initiating and Planning

200-2 identify problems to be solved

200-5 identify materials and suggest a plan for how they will be used

Performing and Recording

201-1 follow a simple procedure where instructions are given one step at a time

201-3 use appropriate tools for manipulating and observing materials and in building simple models

201-6 estimate measurements

201-8 follow given safety procedures and rules and explain why they are needed

Analysing and Interpreting

202-3 identify the most useful method of sorting for a specific purpose

202-5 identify and suggest explanations for patterns and discrepancies in observed objects and events

202-8 compare and evaluate personally constructed objects with respect to their form and function

202-9 identify new questions that arise from what was learned

Communication and Teamwork

203-2 identify common objects and events, using terminology and language that others understand

203-3 communicate procedures and results, using drawings, demonstrations, and written and oral descriptions

203-5 respond to the ideas and actions of others and acknowledge their ideas and contributions