Prince Edward Island
CANADA

Department of Education
English Programs

# Atlantic Canada Science Curriculum

# Science

## Grade 3

CURRICULUM

# Acknowledgements

The departments of education of New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island gratefully acknowledge the contributions of the following groups and individuals toward the development of this grade 1 science curriculum guide.

- The Regional Elementary Science Curriculum Committee; current and past representatives include the following:

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- The Provincial Curriculum Working Group, comprising teachers and other educators in Prince Edward Island, which served as lead province in drafting and revising the document.
- The teachers and other educators and stakeholders across Atlantic Canada who contributed to the development of the grade 1 science curriculum guide.

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# Foreword

The pan-Canadian *Common Framework of Science Learning Outcomes K to 12*, released in October 1997, assists provinces in developing a common science curriculum framework.

New science curriculum for the Atlantic Provinces is described in *Foundation for the Atlantic Canada Science Curriculum (1998)*.

This curriculum guide is intended to provide teachers with the overview of the outcomes framework for science education. It also includes suggestions to assist teachers in designing learning experiences and assessment tasks.

# Introduction

## Background

The curriculum described in *Foundation for the Atlantic Canada Science Curriculum* 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 students need to develop inquiry, problem-solving, and decision-making abilities; to become life-long 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 they engage in, 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.

## Writing in Science

Learning experiences should provide opportunities for students to use writing and other forms of representation as ways to 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 also an instrinsic part of learning in science that can help students better record, organize, and understand information from a variety of sources. The process of creating webs, maps, charts, tables, graphs, drawing, and diagrams to represent data and results help 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. It is through opportunities to talk and write about the concepts they need to learn that 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. 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 but they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

## Meeting the Needs of All Learners

The *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 class. 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 utilize 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 provide 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.

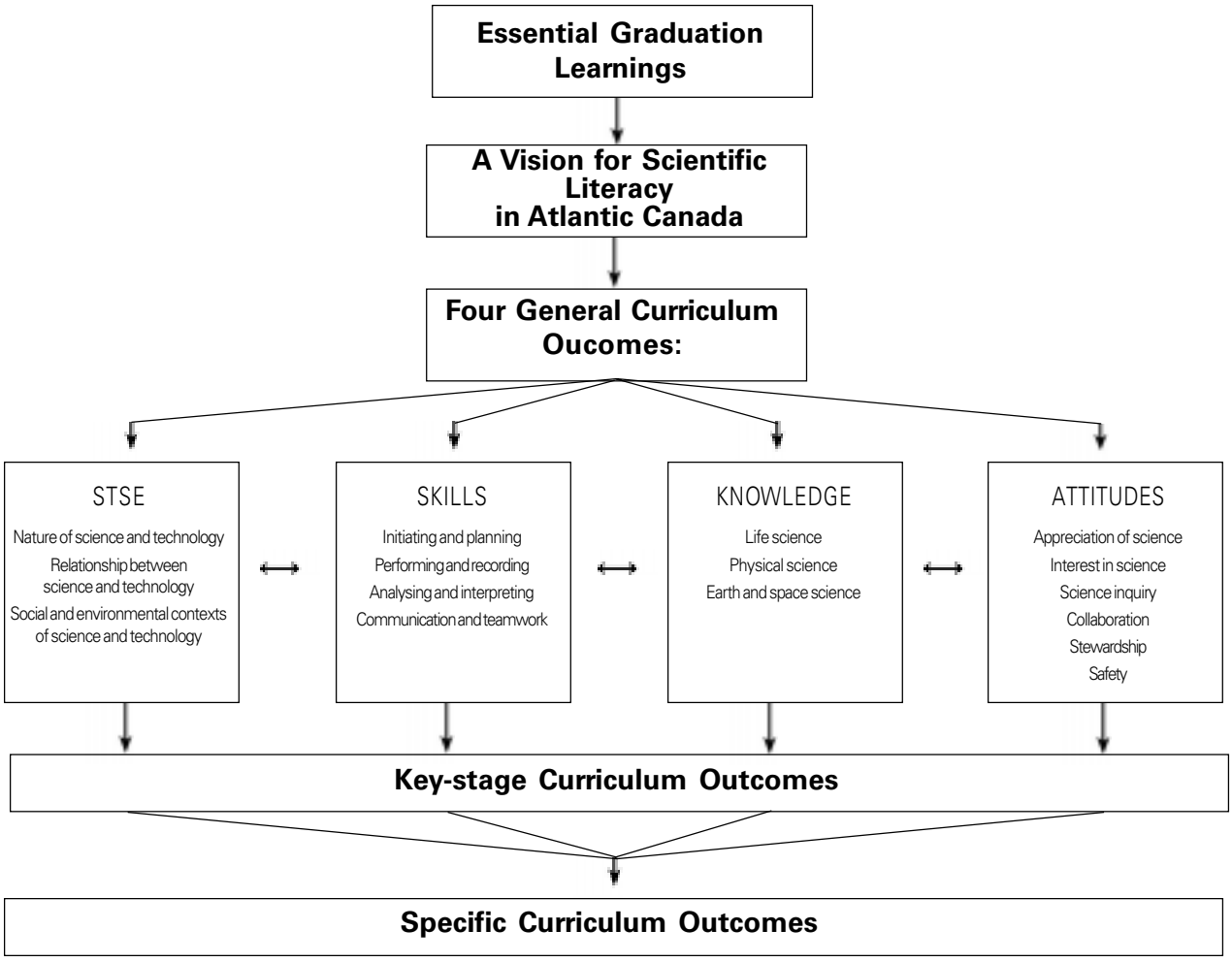
# Curriculum Outcomes Framework

## 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*. Figure 1 provides the blueprint of the outcomes framework.

### Outcomes Framework

**FIGURE 1**



## 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:

*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

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 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 for Science Learning Outcomes K-12*.

## Specific 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 units for each grade level.

## Attitude 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 a 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. These key-stage attitudinal outcome statements can be found in the appendix.

## Curriculum Guide Organization

Specific curriculum outcomes are organized in 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, etc. 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 three-page synopsis. On the first page, introductory paragraphs provide an 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 three-page overview provides a table of the outcomes from the pan-Canadian *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

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

The pan-Canadian Science Learning Outcomes were used as the framework in the development of the Atlantic Canada Science Curriculum at this grade level. They are included to illustrate the two types of science outcomes at the primary level: i.e., *STSE/ Knowledge* and *Skills*. For planning, instructional, and assessment purposes, teachers should refer to the PEI/APEF Specific Curriculum Outcomes found on the third overview page.

The third page of the three-page overview provides a table of the PEI/APEF specific curriculum outcomes for the unit. Each unit is divided into subtopics to reflect a possible grouping of the specific curriculum outcomes.

## 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 page.

*Two Page, Four Column Spread*

*Column One: Outcomes*



**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)
- ask questions to investigate related to growing conditions for plants (200-1)
- make predictions about which conditions will be the best for plant growth (200-3)
- make and record relevant observations and measurements of plant growth during their investigations (201-5)
- construct and label bar graphs that show plant growth under different conditions (202-4)

**Elaborations–Strategies for Learning and Teaching**

Read ahead to the unit on "Soil." It has outcomes related to soil factors and how it interacts with living things. It is recommended that you 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 could 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. **Caution: Allergy Alert.** Teachers should be aware of any nut allergies if these are to be used in this activity. ⚠

Teachers could assess the students' knowledge of plant needs. Students should generate questions that they might wish to investigate related to possible conditions in which 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. ⚠

Do not use commercial seeds that have been treated with powder fungicide. **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 the conditions that they will be using somewhere on the pot or cup, so that plants don't get mixed up. 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, 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, could be used to generate the graph.

. . . continued



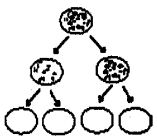


**Investigating Germination and Growing Conditions for Plants**

**Tasks for Instruction and/or Assessment**

*Performance*

- From all of the seeds you have been given, decide on a way to group them. (202-2)



- Fill in the chart "Helping Plants Grow" as you test conditions for growing plants. When you are finished, construct a bar chart to show the plants growth.

From the list of conditions 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. (201-5, 202-4)

**Helping Plants Grow**

| Conditions | Factors affecting plant growth |
|---|---|
| Date | Observations and drawings (include height of plant) |
| | |
| : | |

*Journal*

- I would like to find out if ... can make my plant grow faster. I predict that if ... (200-1, 200-3)

*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, light, and soil type and depth. (200-3)

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**Resources**

*Lesson/Activity in Addison Wesley Resource*

**202-2**
Lesson 3, page 15

**200-1**
Launch, page 7
Lesson 3, page 15
Lesson 6, page 24

**200-3**
Lesson 4, page 18
Lesson 6, page 24
Lesson 13, page 46

**201-5**
Lesson 3, page 15
Lesson 4, page 18
Lesson 8, page 31
Addison Wesley, Soil, Lesson 5, page 2

**202-4**
Lesson 6, page 24

Key:
L = Launch
X = Outcome addressed through student book and Teacher's Guid
TG = Outcome addressed through Teacher's Guide only
DP = Design Project

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 parenthesis 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 sequence to meet the learning needs of their students.

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.

*Column Three: Tasks for Instruction and/or Assessment*

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.

The third column provides suggestions for ways that 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 are organized in relation to several outcomes. The assessment item identifies the outcome(s) addressed by the outcome number in brackets after the item.

*Column Four: Resources/ Notes*

This column provides correlations of outcomes to authorized 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 have been developed 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.

# pan-Canadian Science Learning Outcomes

N.B. The following pan-Canadian Science Learning Outcomes were used as the framework in the development of the Atlantic Canada Science Curriculum at this grade level. They are included here to illustrate the two types of science outcomes at the primary level: i.e., *STSE/Knowledge* and *Skills*. **For planning, instructional, and assessment purposes, teachers should refer to the PEI/APEF Specific Curriculum Outcomes found on the next page.**

## STSE/Knowledge

**100-29** identify and investigate life needs of plants and describe how plants are affected by the conditions in which they grow

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

**100-30** observe and describe changes that occur through the life cycle of a flowering plant

**102-12** describe ways in which plants are important to living things and the environment

**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

## Skills

**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**

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

**201-6** estimate measurements

**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

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

**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

# PEI/APEF Specific Curriculum Outcomes

## Investigating Germination and Growing Conditions for Plants

*Students will be expected to*

- place seeds in groups according to one or more attributes (202-2)
- ask questions to investigate related to growing conditions for plants (200-1)
- make predictions about which conditions will be the best for plant growth (200-3)
- make and record relevant observations and measurements of plant growth during their investigations (201-5)
- construct and label bar graphs that show plant growth under different conditions (202-4)
- draw inferences that identify and investigate life needs of plants and describe how plants are affected by the conditions in which they grow (100-29)
- identify and describe parts of plants and their general function (100-28, 203-2)
- identify and suggest explanations for patterns and discrepancies in the growth rate of similar plants grown in varying conditions (202-5)

## The Life Cycle of a Plant

*Students will be expected to*

- observe and describe changes, using written language, pictures, and charts, that occur through the life cycle of a flowering plant (100-30, 201-5)
- estimate measurements of the plant as it grows (201-6)

## Uses for Plants

*Students will be expected to*

- describe ways in which plants are important to living things and the environment (102-12)
- 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 (102-13)
- respond to the ideas and actions of others and acknowledge their ideas about the uses and replenishing of plants (203-5)

## 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)
- ask questions to investigate related to growing conditions for plants (200-1)
- make predictions about which conditions will be the best for plant growth (200-3)
- make and record relevant observations and measurements of plant growth during their investigations (201-5)
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### Elaborations–Strategies for Learning and Teaching

Read ahead to the unit on "Soil." It has outcomes related to soil factors and how it interacts with living things. It is recommended that you 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 could 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. **Caution: Allergy Alert**. Teachers should be aware of any nut allergies if these are to be used in this activity.

Teachers could assess the students' knowledge of plant needs. Students should generate questions that they might wish to investigate related to possible conditions in which 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.

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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, could be used to generate the graph.

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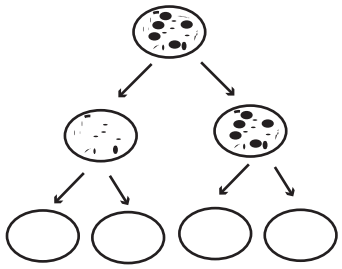
## Investigating Germination and Growing Conditions for Plants

### Tasks for Instruction and/or Assessment

*Performance*



- From all of the seeds you have been given, decide on a way to group them. (202-2)

- Fill in the chart "Helping Plants Grow" as you test conditions for growing plants. When you are finished, construct a bar chart to show the plants growth.

  From the list of conditions 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. (201-5, 202-4)

**Helping Plants Grow**

| | |
|---|---|
| **Conditions** | Factors affecting plant growth |
| **Date** | Observations and drawings (include height of plant) |
| | |
| **:** **:** | |

*Journal*

- I would like to find out if ... can make my plant grow faster. I predict that if ... (200-1, 200-3)

*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, light, and soil type and depth. (200-3)

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### Resources

*Lesson/Activity in Addison Wesley Resource*

**202-2**

Lesson 3, page 15

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Lesson 6, page 24

**200-3**

Lesson 4, page 18

Lesson 6, page 24

Lesson 13, page 46

**201-5**

Lesson 3, page 15

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Addison Wesley, **Soil**, Lesson 5, page 22

**202-4**

Lesson 6, page 24

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

DP = Design Project

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

### Outcomes

Students will be expected to

- draw inferences that identify and investigate life needs of plants and describe how plants are affected by the conditions in which they grow (100-29)

- identify and describe parts of plants and their general function (100-28, 203-2)
- identify and suggest explanations for patterns and discrepancies in the growth rate of similar plants grown in varying conditions (202-5)

### Elaborations–Strategies for Learning and Teaching

Students should identify the conditions needed for plant growth (light, water, food, and space). They should describe the results and draw pictures to illustrate their plants. Based on their observations, students should draw inferences about the needs of plants. Based on an experiment growing plants in different amounts of light, student can infer light affects how plants grow. Students could investigate how these conditions would affect other plants, for example, cacti, aquatic plants, epiphyte (plants that grows on another plant for support, but which is not a parasite), or hydroponic plants (plants that grow with their roots immersed in a nutrient water solution).

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 could 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**, **leaves**). The functions of various parts can be explored through classroom discussion and observation, drawing on the results of their investigations, print and electronic resources. Students can draw, label and name a variety of local plants.

Appropriate descriptions of part of plants and their general functions by grade 3 students would include the following:

**Root**: the part of a plant that holds the plant in the ground, absorbs water and nutrients and stores food.

**Stem** or **trunk**: the part of a plant that holds the plant up and carries water and nutrients from the roots to the leaves.

**Seed**: a plant grows from this.

**Flower**: the part of the plant that makes seeds.

**Leaf**: the part of a plant where food for the plant is made.

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

### Tasks for Instruction and/or Assessment

*Journal*

- I am a plant. The conditions I need for growth are ... (100-29)

*Paper and Pencil*

- Draw pictures of the plants in your class that grew under different conditions. Which plants grew best? Tell me why? (100-29, 202-5)

*Interview*

- What are the conditions that affects the growth of plants? (100-29)
- What do you think the roots do? (Teachers can question about other plant parts throughout this unit.) (100-28, 203-2)

### Resources

*Lesson/Activity in Addison Wesley Resource*

**100-29**

Lesson 4, page 18

Lesson 6, page 24

Lesson 8, page 31

Lesson 9, page 34

Lesson 10, page 37

Lesson 13, page 46

Lesson 14, page 49

DP, page 53

Addison Wesley, **Soil**, Lesson 5, page 22

**100-28, 203-2**

Lessons 1, 2 and 3, pages 10-17

Lesson 5, page 21

Lesson 7, page 27

Lessons 9, 10 and 11, pages 34-43

**202-5**

Lesson 14, page 49

Addison Wesley, **Soil**, Lesson 5, page 22

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

DP = Design Project

# The Life Cycle of a Plant

## Outcomes

Students will be expected to

- observe and describe changes, using written language, pictures, and charts, that occur through the life cycle of a flowering plant (100-30, 201-5)
- estimate measurements of the plant as it grows (201-6)

## Elaborations–Strategies for Learning and Teaching

Students should grow flowering plants or have an opportunity to observe flowering plants (such as marigolds, bulbs) over a long period of time. Students could plant seeds in a container that allows a view of the seed as it germinates. Consider using a paper towel-lined glass jar with soil in centre, or in 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 could use drawings to record their observsations of the plant's life cycle, estimate the lengths of the various parts of the plants (for example, leaf size, root length, plant height), and take measurements. This activity can be used to address mathematics outcomes in measurement. Students could observe the bloom using a magnifying glass. 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 (clippings, bulbs, or the eye of a potato).

Students can investigate through hands-on experiences, 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 the seeds are then spread by the wind.

## 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, 201-5)
- Draw or cut out pictures of the stages of 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. (100-29, 100-30)
- Fill in the table below.

**Growth/Prediction Chart**

| Week | Predicted Growth | Actual Growth |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

### Resources

*Lesson/Activity in Addison Wesley Resource*

**100-30, 201-5**

Lesson 3, page 15

Lesson 5, page 22

Lesson 8, page 31

**201-6**

Lesson 3, page 15

Lesson 6, page 24

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

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## Uses for Plants

### Outcomes

Students will be expected to

- describe ways in which plants are important to living things and the environment (102-12)
- 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 (102-13)

### Elaborations–Strategies for Learning and Teaching

Students should describe the importance of plants to living things such as shelter, food, and oxygen. Students should explore a variety of uses for plants. Students could be introduced to products and processes, derived from plants, that have been developed to meet the needs of humans. Students, in groups or individually, could explore a use for plants, and present their findings to the class. These outcomes could reinforce social studies outcomes that deal with the vegetation of their province and how people in their province make a living from and use plants. Students could 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 could collect local wildflowers, and practice arranging them, drying them, and making a variety of craft items using them.
- Medicines (for example, garlic, ginseng): Students could interview people in their community to find out natural remedies using specific foods, and make a poster or collage to illustrate their findings.
- Dyes [for example, beet (red), blueberries (blue), onions (yellow)]: Students could 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 could make paper, do some basket weaving, or bring in clothes made from cotton.

. . . continued

## Uses for Plants

### Tasks for Instruction and/or Assessment

*Journal*

- You are an organism living in a forest. Describe how plants are important to your survival. (102-12)
- What would happen if you were an organism that depended on trees and the trees where harvested? (102-12)

*Paper and Pencil*

- Which of the things below contain plant parts? (Include pictures such as books, furniture, food, metal products.) (102-13)
- Classify food items according to the plant part used. (102-13)

**How We Use Plants**

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

*Interview*

- Describe ways plants are important to us and all living organisms. (102-12)

*Presentation*

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

. . . continued

### Resources

*Lesson/Activity in Addison Wesley Resource*

**102-12**

Launch, page 7

Lesson 6, page 24

Lessons 10, 11, 12, 13 and 14, pages 37-51

**102-13**

Lesson 2, page 12

Lessons 10 and 11, pages 37-42

*Science Safety Guide*

**102-12**

Lesson One

Plants: A Breath of Fresh Air

Lesson Two

Pollution Patrol: Plants and Our Environment

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

DP = Design Project

## Uses for Plants (continued)

### Outcomes

Students will be expected to

- 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 (102-13)

- respond to the ideas and actions of others and acknowledge their ideas about the uses and replenishing of plants (203-5)

### Elaborations–Strategies for Learning and Teaching

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

Students should explore the issues of the uses and replenishing of plants using a role play activity where students would formulate the ideas and propose solutions to various environmental issues. Students could work in groups, and each group would work on a specific issue.

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, farms, garden shop, florist, logging camps, seashore, companies employing silvaculture techniques, paper mills, or a factory that processes fruit, vegetables, flowers, or trees, or interview farmers, gardeners, environmentalists, grocers, and 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 ... (203-5)

*Interview*

- Why is it important to replenish plants in our environment? (203-5)

*Presentation*

- Develop a presentation about being a user of plants which illustrates why it is important to replenish plants. (203-205)

*Portfolio*

- Select a piece(s) of work from this unit to put in your portfolio.

### Resources

*Lesson/Activity in Addison Wesley Resource*

**102-13**

Lesson 2, page 12

Lessons 10 and 11, pages 37-42

**203-5**

Lesson 12, page 43

**Key:**

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# Earth and Space Science: Exploring Soils

## Introduction

Students soon discover that there is more to soil than just dirt. It is a place for plants and animals 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 focusing on the ways 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 is 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”.

# pan-Canadian Science Learning Outcomes

N.B. The following pan-Canadian Science Learning Outcomes were used as the framework in the development of the Atlantic Canada Science Curriculum at this grade level. They are included here to illustrate the two types of science outcomes at the primary level: i.e., *STSE/Knowledge* and *Skills*. **For planning, instructional, and assessment purposes, teachers should refer to the PEI/APEF Specific Curriculum Outcomes found on the next page.**

## STSE/Knowledge

Students will be expected to

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

**100-37** investigate and describe soil components

**100-38a** describe the effect of moisture on characteristics (e.g., how it holds together (cohesion), texture, colour) of the soils

**100-38b** compare the absorption of water by different soils

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

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

# PEI/APEF Specific Curriculum Outcomes

## Investigating Soils Composition

*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)
- explore and describe a variety of soils and find similarities and differences among them (100-36)
- investigate and describe soil components using appropriate tools such as spoons, magnifying glasses, jars, and filters (100-37, 201-3)
- make and record observations and measurements in investigations related to soil composition (201-5)
- propose an answer to initial question related to soil composition based on their investigations (202-7)

## Water Absorption of Soils

*Students will be expected to*

- describe the effect of moisture on characteristics of the soils (100-38a)
- make predictions about the absorption of water by different types of soil that lead to exploration and investigation (200-3)
- compare the absorption of water by different soils (100-38b)
- construct and label bar graphs to show the amount of water absorbed by the different soils samples (202-4)
- place containers of soil in order of their ability to absorb water (202-2)
- communicate procedures and results of investigations related to test water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions (203-3)

## Moving Water and Soil

*Students will be expected to*

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

## Interactions of Living Things and Soils

*Students will be expected to*

- investigate and describe how living things affect and are affected by soils (100-35)
- identify and use a variety of sources of science information to gather information about how living things affect and are affected by soils (201-7)

## Technological Products and Processes Related to Soils

*Students will be expected to*

- demonstrate and describe ways of using earth materials to make useful objects (101-12)
- communicate questions, ideas, and intentions while using earth materials to make useful objects (203-1)

## 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)
- explore and describe a variety of soils and find similarities and differences among them (100-36)
- investigate and describe soil components using appropriate tools such as spoons, magnifying glasses, jars, and filters (100-37, 201-3)
- make and record observations and measurements in investigations related to soil composition (201-5)
- propose an answer to initial question related to soil composition based on their investigations (202-7)

### Elaborations–Strategies for Learning and Teaching

This unit could be easily 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 "What I would like to find out". Some of things that they might know could be "Soil has worms in it", "Soil helps plants grow", or "Soil has dirt and 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?" or "How is soil made?". Some of these questions will be investigated during this unit. Soil composition questions 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 banks, 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 back yards, they probably will get a totally different soil composition than one from a more natural setting, 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 jar, adding water, and shaking it. The jar 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.

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 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 $\frac{3}{4}$ 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 notebook.
  - Compare your soil sample composition with that of other classmates. (100-36, 100-37, 201-3, 201-5)
- Using different size 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)

*Journal*

- Things I learned about different types of soils. (202-7)

*Paper and Pencil*

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

*Interview*

- Are there places in your community where the soil is different? Compare the soil from a pasture to the soil on a mountain, or on a river bank. (202-7)

### Resources

*Lesson/Activity in Addison Wesley Resource*

**200-1, 200-3**

Launch and Lesson 1, pages 7-12

**100-36**

Lesson 3, page 16

**100-37, 201-3**

Lessons 1, 2, 3 and 4, pages 10-21

DP, page 47

**201-5**

Lessons 1, 2, 3 and 4, pages 10-21

DP, page 47

**202-7**

Lesson 4, page 19

*Science Safety Guide*

**200-1, 200-3**

Lesson One

Cave-Ins: Staying Safe Around Soil

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

DP = Design Project

## Water Absorption of Soils

### Outcomes

Students will be expected to

- describe the effect of moisture on characteristics of the soils (100-38a)
- make predictions about the absorption of water by different types of soil that lead to exploration and investigation (200-3)
- compare the absorption of water by different soils (100-38b)
- construct and label bar graphs to show the amount of water absorbed by the different soil samples (202-4)
- place containers of soil in order of their ability to absorb water (202-2)
- communicate procedures and results of investigations related to test 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 a plastic cup with small holes poked in the bottom. (A variety of soil types can be obtained from hardware stores or garden shops.) Students can pour in equal amounts 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 practice 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 wouldn’t you?” and “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 their 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. (100-38a)

**Properties of Soils**

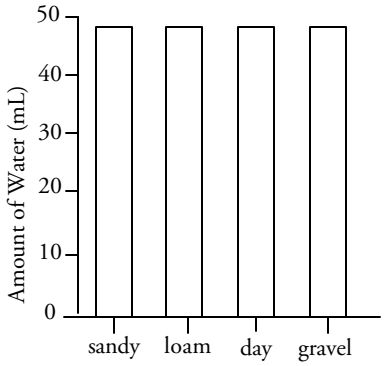
| Type of Soil (clay, sandy, loamy, etc.) | Colour, Texture and Size (drawing of sample particle) | Ability to hold together when dry | Ability to hold together when wet | Colour when wet |
|---|---|---|---|---|
| clay | tiny red-dish parti-cles | can squish together, but will fall apart easily | clumps together and can form a ball | reddish-brown |
| | | | | |
| | | | | |

- Put four or five small holes (the size of a skewer) in the bottom of a styrofoam cup. Put 125 mL $\left(\frac{1}{2} \text{ cup}\right)$ 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.

**Soils Absorb Water**

| Soil Type or description | Amount of water absorbed |
|---|---|
| sandy | |
| loam or potting soil | |
| clay | |
| : : | |

**How much water does soil hold?**




Compare your results to your classmates for different types of soils, and draw a bar chart to display your class results. (100-38b, 202-4, 202-2, 203-3)

### Resources

*Lesson/Activity in Addison Wesley Resource*

**100-38a**

Lesson 5, page 22

**200-3**

Lesson 5, page 22

**100-38b**

Lesson 5, page 22

**202-4**

Lesson 5, page 22

**203-3**

Lesson 5, page 22

**Key:**

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## Moving Water and Soil

### Outcomes

Students will be expected to

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

### Elaborations–Strategies for Learning and Teaching

Students should record their procedures and investigations using drawings, demonstrations and written/oral presentations.

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 those that 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 school yard after a particularly heavy rain, looking at the ground near an eavestrough run-off, 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 plants growth on erosion. Students can use small aluminum foil pie plates with a few holes in the bottom for drainage, and plant grass seed in one, and various other seeds in the rest. Leave 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 besides many new highways. It provides a means of preventing erosion until grass or other plants can grow, or making ridges in the soil that run perpendicular to the flow of water (contor plowing). This is a common technique used by farmers when plowing their 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. Farmers often leave unplowed buffer zones next to waterways so that water will not erode the soil on the field into the river or stream.

## 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. (100-39)

  What happens to the soil? Do you notice any difference between the types of particles that were washed away and the ones that stayed?

- 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)

### Resources

*Lesson/Activity in Addison Wesley Resource*

**100-39**

Lesson 12, page 43

*Science Safety Guide*

**100-39**

Lesson One

Cave-Ins: Staying Safe Around Soil

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## 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)

- identify and use a variety of sources of science information to gather information about how living things affect and are affected by soils (201-7)

### Elaborations–Strategies for Learning and Teaching

Investigations should 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 or wax paper and observe what crawls out of and through the soil, or 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, an ant farm, or a similar device made with two sheets of plexiglass held about 2 cm apart, with 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 glass and paper towel. Popcorn will sprout and roots and leaves are visible to observe.

Students can make a 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, and 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 are open are fairly cold, should be kept inside in small amounts to speed up the process. Students can explore the advantages of composting, and the uses for compost material.

Students could also explore the decomposing of materials by making a 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, 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? Why do you think worms are 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. Why do you think roots need soil? (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 and sand** | **Clay and sand, mixed with compost** |
|---|---|---|---|
| (insert date) | Observations | | |
| | Growth Measurement | | |
| (one week later) | Observations | | |
| | Growth Measurement | | |
| ⋮ | | | |

### Resources

*Lesson/Activity in Addison Wesley Resource*

**100-35**

Launch, page 7

Lessons 6-12, pages 26-45

**201-7**

Lesson 7, page 29

Lesson 9, page 35

*Science Safety Guide*

**100-35**

Lesson One

Cave-Ins: Staying Safe Around Soil

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

DP = Design Project

## Technological Products and Processes Related to Soil

### Outcomes

Students will be expected to

- demonstrate and describe ways of using earth materials to make useful objects (101-12)
- communicate questions, ideas, and intentions while using earth materials to make useful objects (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.

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, 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

*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)
- 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. (203-1)

*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. (203-1)

### Resources

*Lesson/Activity in Addison Wesley Resource*

**101-12**

Lesson 11, page 40

**203-1**

Lesson 11, page 40

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

DP = Design Project

# 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 these forces can be applied or can affect their daily life.

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

## Focus and Context

Inquiry, in the form of observation making 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 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."

# pan-Canadian Science Learning Outcomes

N.B. The following pan-Canadian Science Learning Outcomes were used as the framework in the development of the Atlantic Canada Science Curriculum at this grade level. They are included here to illustrate the two types of science outcomes at the primary level: i.e., *STSE/Knowledge* and *Skills*. **For planning, instructional, and assessment purposes, teachers should refer to the PEI/APEF Specific Curriculum Outcomes found on the next page.**

| STSE/Knowledge | Skills |
|---|---|
| Students will be expected to | Students will be expected to |
| **102-14** identify familiar uses of magnets | **Initiating and Planning** |
| **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 | **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 | **Performing and Recording** |
| **101-8** describe and demonstrate ways to use everyday materials to produce static electric charges, and describe how charged materials interact | **201-1** follow a simple procedure where instructions are given one step at a time |
| **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 | **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 |
| | **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 |

# PEI/APEF Specific Curriculum Outcomes

### Magnetic Forces

*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)
- investigate to identify and group materials that can be magnetized and materials that are attracted by magnets, and distinguish these from materials that are not attracted to magnets (100-31, 202-2)
- follow a simple procedure where instructions are given one step at a time to increase and test the strength of a temporary magnet by stroking it or storing it next to a stronger magnet (201-1)
- identify problems to be solved related to magnetizing materials (200-2)
- propose answers to questions raised related to magnetizing materials (202-7)
- make predictions about the number of objects that can be picked up by a magnet under different conditions (200-3)
- make and record relevant observations in investigations on the number of objects that can be picked up by a magnet under different conditions, and use the observations to identify conditions that affect the force of magnets (100-33, 201-5)
- identify familiar uses of magnets (102-14)
- in cooperative groups, construct and evaluate a toy that is moved by attractive or repulsive magnetic forces (201-3, 202-8, 203-5)

### Electrostatic Forces (Forces arising from Static Electricity)

*Students will be expected to*

- describe and demonstrate ways to use everyday materials to produce static electric charges, and describe how charged materials interact (attract, repel) (101-8, 203-3)
- identify materials to be used to investigate conditions affecting the force of static electricity, and suggest ways to use them in their investigations (202-7)
- make and record relevant observations in investigations related to identify conditions that affect the force of static electricity, and draw simple conclusions that identify these conditions (100-33, 201-5, 202-7)
- identify new questions from what has been learned about static electricity (202-9)
- 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 (102-15)

## Magnetic Forces

### Outcomes

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)
- investigate to identify and group materials that can be magnetized and materials that are attracted by magnets, and distinguish these from materials that are not attracted to magnets (100-31, 202-2)
- follow a simple procedure where instructions are given one step at a time to increase and test the strength of a temporary magnet by stroking it or storing it next to a stronger magnet (201-1)
- identify problems to be solved related to magnetizing materials (200-2)
- propose answers to questions raised related to magnetizing materials (202-7)

### Elaboration–Strategies for Learning and Teaching

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

*Background for teacher: 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.*

Students can 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 don't appear to be very strong, or magnets that are so strong that pins or staples that 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. They can be 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 that were attracted. They can then repeat this procedure a number of times, and test and record the number of staples that are attracted. Students should be instructed in the proper way to handle and store magnets. Magnets gradually lose their strength if they are dropped repeatedly, or stored improperly.

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.

. . . continued

## Magnetic Forces

### Tasks for Instruction and/or Assessment

*Performance*

- Complete the chart 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. (100-32)
- Scatter iron filings on a sheet of paper, and scatter salt on a second sheet. Hold different shapes, sizes and strengths of magnets under each sheet, and draw what you see when you slightly jiggle the sheets. (100-31, 202-2)

*Journal*

- Today I learned about magnets ... (Look for words like attract, repel, north, south in their description 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 for storing bar magnets? (200-2)
- Are all metals attracted to magnets? (200-2)
- How can you make a nail a stronger magnet? How can you make it weaker? (201-1)

**Caution: Do not hold magnets close to computers, computer disks, video or audio tapes.**

. . . continued

### Resources

***Lesson/Activity in Addison Wesley Resource***

**100-32**

Lessons 9 and 10, pages 27-30

**100-31, 202-2**

Lessons 2 and 3, pages 11-14
Lesson 5, page 17
Lesson 8, page 24
DP, page 43

**201-2**

Lesson 8, page 24

**200-2**

Lesson 4, page 15
Lesson 8, page 24
Lesson 10, page 29

**202-7**

Lesson 8, page 24
Lesson 10, page 29

***Safety Science Guide***

200-2, 102-14
Lesson One
Magnets: The Safety Rules of Attraction

**Key:**

L = Launch
X = Outcome addressed through student book and Teacher's Guide
TG = Outcome addressed through Teacher's Guide only
DP = Design Project

## Magnetic Forces (continued)

### Outcomes

Students will be expected to

- make predictions about the number of objects that can be picked up by a magnet under different conditions (200-3)
- make and record relevant observations in investigations on the number of objects that can be picked up by a magnet under different conditions, and use the observations to identify conditions that affect the force of magnets (100-33, 201-5)
- identify familiar uses of magnets (102-14)
- in cooperative groups, construct and evaluate a toy that is moved by attractive or repulsive magnetic forces (201-3, 202-8, 203-5)

### Elaboration–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 could 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). They can then start to investigate the conditions identified in their brainstorming.

From their investigations, students should use their observations to make inferences which they can share with the class.

After explorations involving magnets, students should be able to recognize the fact that magnets are much stronger the closer they are to magnetic materials. Also, students should recognize that not all magnetic materials react in the same way to magnets.

Students can identify places in their lives where magnets are used on a regular basis. Students may be able to relate fridge magnets, doors that close because of magnets and magnetic tools (screwdrivers).

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 toy to move.

## Magnetic Forces (continued)

### Tasks for Instruction and/or Assessment

*Performance*

- Complete the chart as you investigate how to increase the magnetism of an iron nail. (200-3, 100-33, 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 boy or girl that can climb walls; a car that can be controlled. (201-3, 202-8, 203-5)
- Complete the chart as you investigate the factors that you think might affect the strength of the magnetic force . (100-33, 201-5)

**Factors affecting the Strength of a Magnet**

| # of sheets of paper between magnet and staples | # of staples picked up | Distance from magnet | # of staples picked up |
|---|---|---|---|
| 1 | | 0 cm | |
| 2 | | 1 cm | |
| ⋮ | | ⋮ | |

*Journal*

- My testing proved I could make a magnet stronger by ... The types of things that are attracted to magnets are ... (202-7)

*Presentation*

- Show the class the magnetic toy that you made. Explain how it works using terms like “attract” and “repel”or “pull” or “push”. (201-3, 202-8, 203-5)

### Resources

***Lesson/Activity in Addison Wesley Resource***

**200-3**

Lesson 4, page 15

Lesson 6, page 19

Lesson 7, page 21

**100-33, 201-5**

Lesson 4, page 15

Lesson 6, page 19

Lesson 7, page 21

Lesson 14, page 40

**201-3, 202-8, 203-5**

DP, page 43

**102-14**

Launch, page 7

Lessons 1 and 2, page 8-12

Lessons 4, 5 and 6, pages 15-20

Lesson 8, page 24

Lesson 10, page 29

Lesson 14, page 40

DP, page 43

***Safety Science Guide***

**100-33**

Lesson One

Magnets: The Safety Rules of Attraction

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher’s Guide

TG = Outcome addressed through Teacher’s Guide only

DP = Design Project

## Electrostatic Forces (Forces arising from Static Electricity)

### Outcomes

Students will be expected to

- describe and demonstrate ways to use everyday materials to produce static electric charges, and describe how charged materials interact (attract, repel) (101-8, 203-3)
- identify materials to be used to investigate conditions affecting the force of static electricity, and suggest ways to use them in their investigations (202-7)
- make and record relevant observations in investigations related to identify conditions that affect the force of static electricity, and draw simple conclusions that identify these conditions (100-33, 201-5, 202-7)

### Elaboration–Strategies for Learning and Teaching

This unit is best done in the winter when the air is usually drier. 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), and 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 |
| | |

Background for teacher: 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 will both be attracted to the original material that it was 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.

. . . continued

## 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, 201-5, 202-7)
- Complete the chart 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, 201-5, 202-7, 203-3)

**Which material will cause the greatest static charge in rubber?**

| balloon rubbed | # 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, 203-3)
- How can you get two balloons that are suspended on threads to move away from each other? (101-8, 202-7, 203-3)

### Resources

***Lesson/Activity in Addison Wesley Resource***

**101-8, 202-2**

Lesson 11, page 31

Lesson 12, page 34

Lesson 14, page 40

**202-7**

Lesson 11, page 31

**100-33, 201-5, 202-7**

Lesson 11, page 31

Lesson 12, page 34

Lesson 14, page 40

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

DP = Design Project

## Electrostatic Forces (Forces arising from Static Electricity) (continued)

### Outcomes

Students will be expected to

- identify new questions from what has been learned about static electricity (202-9)

- 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 (102-15)

### Elaboration–Strategies for Learning and Teaching

Students could discuss 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?", "Why do clothes dried in a clothes dryer have more static than the clothes on a clothes line?"

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, 202-9)

*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

***Lesson/Activity in Addison Wesley Resource***

**202-9**

Lesson 12, page 34

**102-15**

Lesson 11, page 31

Lesson 12, page 34

**Key:**

L = Launch

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# 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 revisions of the original plan as problems are encountered. Testing: Students will test and evaluate their design, compare it 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 help them develop design skills necessary for the grade 6 unit, "Flight".

# pan-Canadian Science Learning Outcomes

N.B. The following pan-Canadian Science Learning Outcomes were used as the framework in the development of the Atlantic Canada Science Curriculum at this grade level. They are included here to illustrate the two types of science outcomes at the primary level: i.e., *STSE/Knowledge* and *Skills*. **For planning, instructional, and assessment purposes, teachers should refer to the PEI/APEF Specific Curriculum Outcomes found on the next page.**

| STSE/Knowledge | Skills |
|---|---|
| **100-34** describe the properties of some common materials and evaluate their suitability for use in building structures | **Initiating and Planning** |
| **101-11** investigate ways to join materials and identify the most appropriate methods for the materials to be joined | **200-2** identify problems to be solved |
| **102-16** identify shapes that are part of natural and human-built structures, and describe ways these shapes help provide strength, stability, or balance | **200-5** identify materials and suggest a plan for how they will be used |
| **101-10** use appropriate tools in safely cutting, shaping, making holes through, and assembling materials | **Performing and Recording** |
| **101-9** test the strength and stability of personally built structures, and identify ways of modifying a structure to increase its strength and stability | **201-1** follow a simple procedure where instructions are given one step at a time |
| **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 | **201-2** manipulate materials purposefully |
| | **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** |
| | **202-5** 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 |
| | **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 |

# PEI/APEF Specific Curriculum Outcomes

### Proposing Solutions to Building Challenges

*Students will be expected to*

- identify problems to be solved while creating structures (200-2)
- describe the properties of some common materials, and evaluate their suitability for use in building structures (100-34)
- investigate ways to join materials and identify the most appropriate methods for the materials to be joined (101-11)
- identify shapes that are part of natural and human-built structures, and describe ways 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 (200-5)

### Creating Solution to Structural Challenges

*Students will be expected to*

- safely use appropriate tools for cutting, shaping, making holes, and assembling materials (101-10, 201-3)
- follow given safety procedures and rules while constructing structures and explain why they are needed (201-8)
- estimate measurements in order to select the required materials for the structure (201-6)
- manipulate materials purposefully in order to create the structure (201-2)
- respond to the ideas of partners while constructing the structure, acknowledge their ideas and contributions, and make changes in the structure as deemed necessary (203-5)

### Evaluate the Structural Solution

*Students will be expected to*

- test the strength and stability of personally built structures, and identify ways of modifying a structure to increase its strength, stability, form and function (101-9, 202-8)
- identify materials or parts of a structure that failed and suggest why (202-5)
- 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)
- illustrate their construction process, using drawings with explanations, demonstrations, and written and/or oral descriptions, and describe the structures and components of structures they have built (203-3, 203-2)

## Proposing Solutions to Building Challenges

### Outcomes

Students will be expected to

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

### 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. Bridge and tower building, or egg-drop containers are common challenges, but teachers and students can use their imagination to think up other tasks that will encourage students to think creatively and critically in creating constructions, and increase their awareness of variety of design structures and materials that can be used in different situations. The task should be well-defined, and the appropriate features (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 problem, 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.

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

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 that a particular material would be well-suited for. For example, cotton balls would not make a suitable material to build our house, but may make an excellent material for a bird's house or insulation or cushioning.

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

Students can also explore ways of joining materials. This would involve them identifying and evaluating some common adhesive materials; identifying and 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™. **Caution: Students are to take care when stapling thick layers of paper/fabric or when using a hammer and nails.**

. . . continued

## Proposing Solutions to Building Challenges

### Tasks for Instruction and/or Assessment

*Performance*

- Make a list, with the class, of the problems which 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.) (101-11)

- Which glue works best for which material? Add a drop of each type of glue to each 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). (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 ... (101-11, 100-34)

*Paper and Pencil*

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

*Interview*

- Which types of materials are you planning on using for your structure? Why? (100-34)

| Material | Structure |
|---|---|
| cement | houses |
| wood | sidewalks |
| plastic | toys |
| : | : |
| : | : |

. . . continued

### Resources

***Lesson/Activity in Addison Wesley Resource***

**200-2**

Lessons 1, 2, and 3, pages 1-17

Lesson 9, page 32

Lesson 13, page 41

DP, page 45

**100-34**

Lesson 3, page 15

Lesson 5, page 21

Lesson 7, page 26

**101-11**

Lesson 2, page 12

Lesson 9, page 32

Lessons 12 and 13, pages 38-43

DP, page 45

**Key:**

L = Launch

X = Outcome addressed through student book and Teacher's Guide

TG = Outcome addressed through Teacher's Guide only

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## Proposed 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 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 (200-5)

### Elaborations–Strategies for Learning and Teaching

Students should 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 gain an appreciation for 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, such as 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 could be identified by the class or teacher as being appropriate for the challenge, and limits put on how much of each material could 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 thing critically about how to best use a limited amount of material.

Have students draw a rough sketch of their plan before starting. They can then use this plan, and refine it as necessary in the next stage of the design process.

Opportunities to hear from an architect about designing structures, or visiting 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. (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, 101-11)

### Resources

***Lesson/Activity in Addison Wesley Resource***

**102-16**

Launch, page 8

Lesson 1, page 10

Lessons 5, 6, 7 and 8, pages 21-31

Lesson 10, page 34

**200-5**

Lessons 2 and 3, pages 12-17

Lesson 9, page 32

Lesson 13, page 41

DP, page 45

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## Creating Solution to Structural Challenges

### Outcomes

Students will be expected to

- safely use appropriate tools for cutting, shaping, making holes, and assembling materials (101-10, 201-3)
- follow given safety procedures and rules while constructing structures and explain why they are needed (201-8)
- estimate measurements in order to select the required materials for the structure (201-6)
- manipulate materials purposefully in order to create the structure (201-2)
- respond to the ideas of partners while constructing the structure, acknowledge their ideas and contributions, and make changes in the structure as deemed necessary (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 cooperatively 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.

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. Background for teacher: teachers could make observations on these aspects of the activity as part of the assessment. Teachers should allow opportunity for changes in the plans, and discuss these changes with students.

Changes in their planning should be noted in their drawing. Students should discuss with their partners why the changes were made.

## Creating Solutions to Structural Challenges

### Tasks for Instruction and/or Assessment

*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. (201-2, 203-5, 201-8)
  - 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 fanning it from 0.5 m away. (201-2, 203-5, 201-8)

*Journal*

- Problems that we had while building our structure are ... We solved them by ... (201-2)

*Interview*

- Describe the structure you are building and how your project is progressing. (203-3)
- What problems did you encounter and how did you deal with them? (203-3)

*Portfolio*

- 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)

*Informal/Formal Observation*

- A checklist as students construct their structures follows: (101-10, 201-3, 203-5, 201-8)
  - Student uses tools safely.
  - Student knows the correct use for each tool.
  - Student communicates and works well with partners.

### Resources

***Lesson/Activity in Addison Wesley Resource***

**101-10, 201-3**

Lesson 6, page 24

Lesson 9, page 32

Lessons 12 and 13, pages 38-43

DP, page 45

**201-8**

Lesson 3, page 15

DP, page 45

**201-6**

Lesson 9, page 32

Lesson 13, page 41

DP, page 45

**201-2**

Lessons 2, 3 and 4, pages 12-20

Lesson 9, page 32

Lesson 13, page 41

DP, page 45

**203-5**

DP, page 45

***Science Safety Guide***

**101-10**

Lesson One

Build It Safely

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## Evaluating the Structural Solution

### Outcomes

Students will be expected to

- test the strength and stability of personally built structures, and identify ways of modifying a structure to increase its strength, stability, form and function (101-9, 202-8)
- identify materials or parts of a structure that failed and suggest why (202-5)
- 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)
- illustrate their construction process, using drawings with explanations, demonstrations, and written and/or oral descriptions, and describe the structures and components of structures they have built (203-3, 203-2)

### Elaborations–Strategies for Learning and Teaching

Once students have finished their structure, 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 design, 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 it was designed. The design process itself is the main focus of this whole exercise. Students learn important strategies and techniques for working together, problem solving, testing their structures, refining their design, and learning from their mistakes and other students. Their ability to work in this manner is what is important. Students may make a structure that doesn't 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)
- Using a sheet of paper and two soup cans, fold the paper to form a bridge that spans the two cans that will hold the most pennies. Test your design against those of your classmates. What things were done to make the strongest bridge? (102-17)
- Using straws and small paper clips (or soaked peas and toothpicks), form a variety of shapes (e.g., triangles, squares, pentagons). Gently push on the shapes to see how stable they are. Which shape is the most stable, and doesn't bend very easily? (102-17)

*Journal*

- Update your journal to include a drawing of your final structure, and how it performed when tested. (203-3, 203-2)
- What I learned from designing a _____ is ... (101-9, 202-8, 102-17)

*Presentation*

- Present your structure to your classmates. Describe problems that you solved, strengths of your design, and weaknesses that you think it has. (203-3, 203-2, 202-5, 102-17)

### Resources

***Lesson/Activity in Addison Wesley Resource***

**101-9, 202-8**

Lessons 2, 3 and 4, pages 12-20

Lessons 6 and 7, pages 24-28

Lesson 13, page 41

DP, page 45

**202-5**

Lesson 4, page 18

Lesson 7, page 26

DP, page 45

**203-3, 203-2**

Lesson 9, page 32

Lesson 13, page 41

DP, page 45

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# Elementary Science Safety

Although experimentation in the elementary years may not be in as much depth as in secondary school, and the equipment and chemicals may not be as sophisticated, the attention to safety is just as important. Safety is an important concern in the elementary science classroom because students are learning new skills and working with unfamiliar equipment and materials that can pose some degree of hazard. Safety in the elementary school science classroom depends upon the wise selection of experiments, materials, resources and field experiences as well as consistent adherence to correct and safe techniques. Some work procedures require thorough planning, careful management and constant monitoring of students' activities. Teachers should be knowledgeable of the properties, possible hazards, and proper use and disposal of all materials used in the classroom.

## The Safe Classroom

Some general principles of safe science classroom management may be identified:

- Prepare, maintain, and prominently display a list of emergency telephone numbers.
- Identify people within the school who are qualified to administer first aid.
- Annually review and complete the safety checklists relevant to your situation.
- Familiarize yourself with the relevant medical histories of individual students.
- Review basic first aid procedures regularly.
- Formulate, in consultant with administration and other teachers, an action plan to deal with accidents in the classroom and also on extracurricular activities such as field trips.

## Non-Hazardous Chemicals

The following chemicals can be used safely by students (but remember that any substance, even salt, can be harmful if taken in sufficient quantity). Be aware that any substance in a fine powder or dust form can be inhaled and thus harm health.

- Aluminum foil
- Baking powder (sodium bicarbonate and tartaric acid)
- Baking soda (sodium bicarbonate)
- Bath salts/Epsom salts (magnesium sulfate)
- Borax (sodium borate)
- Carbonated (fizzy) drinks
- Chalk (calcium carbonate)
- Charcoal (carbon)
- Citric acid crystals
- Clay (moist)
- Copper foil
- Cream of tartar (tartaric acid and potassium hydrogen tartrate)
- Detergents, hand-washing types (but not dishwashing)
- Food colouring
- Glycerine (glycerol)
- Iron filings
- Lemon juice (contains citric acid)
- Marble chips (calcium carbonate)
- Litmus paper or solution
- Milk
- Oils, vegetable and mineral (but not motor oil)
- Plaster of Paris or cellulose fillers ('Polyfilla')
- Salt (sodium chloride)
- Sand
- Soap
- Starch
- Steel wool
- Sugar
- Tea (contains tannic acid)
- Universal (pH) indicator paper or solution
- 'Vaseline'
- Vinegar (dilute acetic acid)
- Vitamin C (ascorbic acid)
- Washing powder, hand-washing types
- Zinc foil

## Dangerous Household Chemicals

Some common products are potentially hazardous and should not be used in the elementary classroom. Consider warning the students about the dangers in their homes.

| | | |
|---|---|---|
| Bleach | Fine powdered substances | Paint strippers |
| Caustic coda (sodium hydroxide) | Fireworks, sparklers and party poppers | Pesticides, fungicides, and insecticides |
| Rust-removal solution | Gasoline and other fuels | Some plant growth substances |
| Dishwasher detergents | Hydrogen peroxide | (e.g. rooting powders) |
| Drain cleaner | (more than a 3% solution) | Scale removers |
| Dry cleaning fluids | Laundry detergents | Toilet cleansers |
| Some fertilizers | Oven cleaners | Weed killers |

## Disposing of Chemicals

- The disposal of non-hazardous, water-soluble liquid wastes (e.g. liquid handsoap, vinegar) should involve diluting the liquid waste before pouring it down the drain, then running tap water down the drain to further dilute the liquid.
- Non-hazardous solid wastes (e.g. iron filings, table salt) should be disposed of in a waste container.
- Hazardous wastes should be placed in specially marked waste containers and disposed of in an appropriate manner.

## Science Safety Rules and Procedures for Elementary Science Students (not a conclusive list)

1. Never do any experiment without the approval and direct supervision of your teacher.
2. Read all written instructions before doing an activity.
3. Listen to all instructions and follow them carefully.
4. Make sure you understand all the safety labels.
5. Always ask your teacher if you do not understand.
6. Wear proper safety protection as instructed by teacher.
7. Never remove your goggles during an activity.
8. Tie back long hair and avoid wearing loose clothing such as scarves, ties or long necklaces.
9. Know the location of safety and first aid equipment.
10. Work carefully and make sure that your work area is not cluttered.
11. Always cut away from yourself and others when using a knife.
12. Always keep the pointed end of scissors or any other sharp object facing away from yourself and others if you have to walk with it.
13. Dispose of broken glass as your teacher directs.
14. Do not smell a substance directly. Fan the smell toward you with your hand.

## Science Safety Rules and Procedures for Elementary Science Students (not a conclusive list) (continued)

15. Never eat or drink in the laboratory.
16. Never drink or taste any substances.
17. Never use cracked or broken glassware.
18. Make sure that your hands are dry when touching electrical cords, plugs, or sockets.
19. Handle hot objects carefully.
20. Tell your teacher immediately if an accident or spill occurs, no matter how minor.
21. Clean equipment before you put it away.
22. Dispose of materials as directed by your teacher.
23. Clean up your work area upon completion of your activity.
24. Wash hands carefully with soap and water after handling chemicals, after all spills and at the end of each activity.

## Plant and Animal Care in the Classroom

(http://www.sasked.gov.sk.ca/docs/elemsci/corgesc.html)

Teachers should familiarize themselves with any local, provincial, or federal statutes pertaining to the care of plants or animals. If in doubt, inquire. Pet shops may have useful information. Remember that there are regulations preventing the picking of some wild flowers, or the captive use of migratory birds or endangered species. The following are some guidelines for the care of plants and animals in the classroom:

- Be wary of any possible signs of allergic reactions among students to any plants or animals.
- Inform the administration before bringing any animals into the school.
- Inquire about specific feeding and facility requirements for classroom pets.
- Be wary of possible diseases that may be spread by animals, or by people to animals.
- Poisonous animals and plants, or other potentially dangerous animals such as venomous snakes and spiders should not be kept in the classroom.
- Wear gloves when handling animals in the classroom. Over-handling can put the animals under excessive stress.
- Involve students in helping to care for plants and animals.
- Make arrangements to have the plants and animals looked after over holidays and on weekends.

(Adapted and used with permission from the Ministry of Education, British Columbia)

## Attitude Outcome Statements

*For grades 1-3, it is expected that students will be encouraged to*

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

## Attitude Outcome Statements

*For grades 1-3, it is expected that students will be encouraged to*

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