Grade 3
Life Science: Plant Growth and Changes

Unit Overview

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.

Curriculum Outcomes

STSE/Knowledge

Students will be expected to

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

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

201-5 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

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)
  Attributes should include:
  - (i) size
  - (ii) shape
  - (iii) colour
  - (iv) appearance
- ask and investigate questions related to growing conditions for plants (200-1)
  - describe the conditions that are necessary for plant growth. Include:
    - (i) air
    - (ii) nutrients
    - (iii) water
    - (iv) sunlight
    - (v) space
    - (vi) warmth
- 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 in effects of living things. Start planting now in preparation for those activities.

Students can bring in a variety of seeds to use in their investigations. In order to address outcomes later in this unit related to the usefulness of plants, the teacher should supply herb or vegetable seeds. **Caution: Do not use commercial seeds that have been treated with powder fungicide.** 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.

In classroom discussion, teachers can talk with students about their knowledge of the plant's needs. Help students generate questions that relate 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. It is not expected that students will investigate all conditions for plant growth.

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.

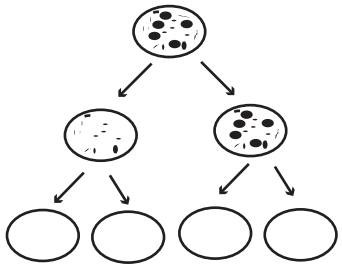
Students should plant their seeds, being careful to record the conditions that they will be using somewhere on the pot or cup, so that plants don't get mixed up. Students should accurately record their observations and measurements of the plant's growth. This activity provides an excellent opportunity 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, can be used to generate the graph.

Investigating Germination and Growing Conditions for Plants

Tasks for Instruction and/or Assessment

Performance



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

Resources

Student textbook module:
Watch It Grow

(202-2)
TR Lesson 6 pp. 38-40
SR pp. 14-15

(200-1)
TR Lessons 3-4 pp. 8-11
pp. 22-26
pp. 27-29

(200-3)
TR Lesson 3 pp. 23-25
Lesson 14 pp. 81-85
pp. 23-25
SR Lesson 3 pp. 8-9

(201-5)
TR Lesson 6 pp. 37-39
SR pp. 14-15

TR Lesson 14 pp. 81-86
SR pp. 30-31

TR Lesson 3 p. 24
SR pp. 8-9

(202-4)
TR Lesson 3 p. 24
SR pp. 8-9

Investigating Germination and Growing Conditions for Plants (continued)

Outcomes

Students will be expected to

- draw conclusions and describe how plants are affected by the conditions in which they grow (100-29)
- identify and explain patterns and discrepancies in the growth rate of similar plants grown in varying conditions (202-5) Inlcude:
  - (i) roots
  - (ii) stem/trunk
  - (iii) flower
  - (iv) seed
  - (v) bark
  - (vi) leaves
- identify and describe parts of plants and their general function (100-28, 203-2)

Elaborations–Strategies for Learning and Teaching

Students should describe the results and draw pictures to illustrate their plants. Based on their observations, students should draw conclusions about the needs of plants. Based on an experiment growing plants in different amounts of light, students can infer light affects how plants grow. Students could investigate how these conditions would affect other plants, for example, cactus, aquatic plant, epiphyte, or hydroponic plants.

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

Students should be encouraged to use appropriate terminology for the parts of the plants. 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.

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

Resources

Student textbook module:
Watch It Grow

(100-29)

TR	Lesson 3	pp. 23-26
SR		pp. 8-9
TR	Lesson 4	pp. 27-31
SR		pp. 10-11
TR	Lesson 6	pp. 38-39
SR		p. 15
TR	Lesson 14	pp. 81-86
SR		pp. 30-31

(202-5)

TR	Lesson 3	pp. 22-25
SR		pp. 8-9
TR	Lesson 4	pp. 27-30
SR		pp. 10-11
TR	Lesson 14	pp. 81-84
SR		pp. 30-31

(100-28, 203-2)

SR	Lesson 1	pp. 4-5
	Glossary	pp. 32-33
TR	Lesson 2	pp. 17-21
SR		pp. 6-7
TR	Lesson 5	pp. 32-36
SR		pp. 12-14
TR	Lesson 7	pp. 42-47
SR		pp. 16-17
TR	Lesson 14	pp. 85-87

The Life Cycle of a Plant

Outcomes

Students will be expected to

- observe and describe changes, that occur through the life cycle of a flowering plant using written language, pictures, and charts (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 over a long period of time (such as marigolds, bulbs). Students can 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 the 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, 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

Student textbook module:
Watch It Grow

(100-30, 201-5)

TR	Lesson 1	pp. 12-16
SR		pp. 4-5
TR	Lesson 6	pp. 37-41
SR		pp. 14-15
TR	Lesson 7	pp. 42-47
SR		pp. 16-17
TR	Lesson 8	pp. 48-51
SR		pp. 18-19
TR	Lesson 13	p. 77
SR		p. 29

(201-6)

TR	Lesson 3	p. 24
SR		pp. 8-9

Uses for Plants

Outcomes

Students will be expected to

- describe ways in which plants are important to living things and the environment (102-12)
  - trees provide a space for plants, for birds to nest, and shade and shelter for others
  - green plants provide the oxygen we breathe
  - provide food, medicine, dyes and material for fabrics
  - help prevent erosion of soil
  - used in making building materials (lumber, plywod) and paper
- 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. This activity reinforces social studies outcomes on sustainability. Students could focus on the following:

- Food: The leaves of some plants can be eaten (e.g., dandelion, beet, lettuce), or used for flavouring (e.g., mint, tea, savoury). The roots of some plants (e.g., turnip, carrots, beets, some flowers (e.g., nasturtiums), and many seeds (e.g., sunflower, poppy) are edible. Students can grow small vegetables such as 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 practise arranging them, drying them, and making a variety of craft items using them.
- Medicines (e.g., 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 (e.g., beet (red), blueberries (blue), onions (yellow): Students could tie-dye white T-shirts using the dyes from local plants.
- Fibres (e.g., cotton, straw used in baskets, cellulose or tree fibres used in making paper, onion skins used for paper): Students could make paper, do some basket weaving, or bring in clothes made from cotton.

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 were 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)

Resources

Student textbook module:
Watch It Grow
(102-12)

TR	Lesson 9	pp. 53-57
SR		pp. 20-21
TR	Lesson 10	pp. 58-64
SR		pp. 22-23
TR	Lesson 11	pp. 65-70
SR		pp. 24-25
TR	Lesson 12	pp. 71-74
SR		pp. 26-27

102-13)

TR	Lesson 10	pp. 58-64
SR		pp. 22-23
TR	Lesson 11	pp. 65-70
SR		pp. 24-25

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) **Cont'd**
- respond to the ideas and actions of others, such as farmers, gardeners, environmentalists, grocers, and loggers, 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 can plant trees around the school yard as a naturalization project.
- Prevent Erosion (e.g., cross-slope plowing for farming). Look in 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 will formulate the ideas and propose solutions to various environmental issues. Students 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 fishers, 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

Student textbook module:
Watch It Grow

(102-13)

TR	Lesson 10	pp. 58-64
SR		pp. 22-23
TR	Lesson 11	pp. 65-70
SR		pp. 24-25

(203-5)

TR	Lesson 10	p. 61
TR	Lesson 13	pp. 75-79
SR		pp. 28-29

Grade 3
Earth and Space Science: Exploring Soils

Unit Overview

Introduction

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

Focus and Context

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

Science Curriculum Links

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

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

Curriculum Outcomes

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

Investigating Soils Composition

Outcomes

Students will be expected to

- discuss and make predictions that lead to exploration and investigation of the composition of soil (200-1, 200-3)
- explore and describe a variety of soils and find similarities and differences among them using: (100-36)
  - (i) colour
  - (ii) texture (sponginess)
  - (iii) smell
  - (iv) ability to clump
- 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)
- draw conclusions to an initial prediction related to soil composition based on their investigations (202-7)

Elaborations–Strategies for Learning and Teaching

This unit could be integrated with the unit, Plant Growth and Changes. As students determine the factors that affect the growth of plants, they should investigate soil type. Teachers should have students fill out a chart with the column headings "What I know about soil" and "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 or 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**.

"Ability to clump" is a soil attribute that is related to the soil moisture content. Teachers could use other tests such as pressing on a paper towel to indicate moisture.

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. Students can spread out dry soil samples on newspapers for examination. 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

Student textbook module:
Down Under

(200-1, 200-3)
TR Lesson 1 pp. 12-16
SR pp. 4-5

(100-36)
TR Lesson 1 pp. 12-15
SR pp. 4-5
TR Lesson 7 pp. 39-43
SR pp. 16-17
TR Lesson 10 pp. 53-57
SR pp. 22-23
TR Lesson 12 pp. 62-66
SR pp. 26-27

(100-37, 201-3)
TR Lesson 2 pp. 17-21
SR pp. 6-7
TR Lesson 7 pp. 39-43
SR pp. 16-17

(201-5)
TR Lesson 10 pp. 53-57
SR pp. 22-23

(202-7)
TR Lesson 7 pp. 39-43
SR pp. 16-17

Water Absorption of Soils

Outcomes	Elaborations–Strategies for Learning and Teaching
Students will be expected to • describe the effect of moisture on characteristics of the soils (100-38a) Include: (i) colour (ii) texture (sponginess) (iii) smell (iv) ability to clump	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?
• make predictions about the absorption of water by different types of soil that lead to exploration and investigation (200-3)	In their explorations, students may notice that some soil samples seem to absorb water more than others. They can make predictions about which soil samples they think will absorb the most, and then test their predictions with detailed investigations.
• compare the absorption of water by different soils (100-38b)	To test the water absorption abilities of various soil samples, students can put the same amount of each (e.g., 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 results 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.
• construct and label bar graphs to show the amount of water absorbed by the different soil samples (202-4)	Students can practise their graphing with both of these activities (mathematics outcome F3).
• place containers of soil in order of their ability to absorb water (202-2)	
• communicate results of investigations related to testing water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions (203-3)	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

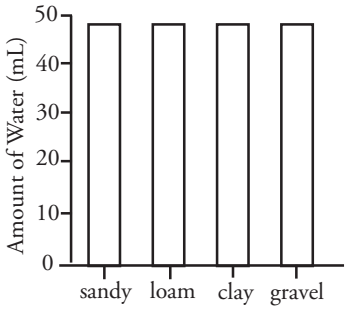
Type of Soil (clay, sandy, loamy, etc.)	Colour, Texture and Size (drawing of sample particle)	Ability to hold together when dry	Ability to hold together when wet	Colour when wet
clay	tiny reddish particles	can squish together, but will fall apart easily	clumps together and can form a ball	reddish brown

- Put four or five small holes (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

Student textbook module:
Down Under

(100-38a)

TR	Lesson 7	pp. 39-43
SR		pp. 16-17
TR	Lesson 10	pp. 53-57
SR		pp. 22-23

(200-3)

TR	Lesson 9	pp. 49-52
SR		pp. 20-21
TR	Lesson 11	pp. 58-61
SR		pp. 24-25

(100-38b)

TR	Lesson 9	pp. 49-52
SR		pp. 20-21

(202-4)

TR	Lesson 9	p. 51

(202-2)

TR	Lesson 9	p. 50
SR		pp. 20-21

(203-3)

TR	Lesson 9	pp. 51-52
SR		pp. 20-21

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) Include:
  - (i) amount of soil movement
  - (ii) how fast soil moves
- define soil erosion as the movement of soil by water
- observe and describe patterns in soil movement in their community. Include:
  - (i) channelling
  - (ii) silting (soil deposits)
- describe ways to prevent soil erosion. Include:
  - (i) planting
  - (ii) rock arrangements

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, ask students to discuss possible effects of moving water on various types of soil. Ask students to 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.

The following activity could be done in conjunction with activities from the unit on Plant Growth and Changes. Given a pile of soil, students can investigate different methods of preventing the soil from washing away. One thing they might try is to investigate the effect of plant growth on erosion. Students 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 beside many new highways. It provided 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 (contour 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 may lose soil from hillsides—ask them to make plowing ridges in a tray of soil in a way that causes least erosion when water is poured on.

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

Student textbook module:
Down Under
(200-1, 200-3)

TR	Lesson 11	pp. 58-61
SR		pp. 24-25

Interactions of Living Things and Soils

Outcomes

Students will be expected to

- investigate and describe how living things affect soil (100-35a)
  Include:
  - (i) breaks soil down into humus
  - (ii) aerate soil
  - list organisms that live in soil.
    Include:
    - (i) earthworms
    - (ii) insects
    - (iii) bacteria
    - (iv) rodents
- investigate and describe how soil affects living things (100-35b)
  Include:
  - (i) provides shelter
  - (ii) provides food
  - (iii) provides space
- 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 and observe to see 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 the 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 them 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, it 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

Student textbook module:
Down Under

(100-35)

TR	Lesson 5	pp. 31-34
SR		pp. 12-13
TR	Lesson 6	pp. 35-38
SR		pp. 14-15
TR	Lesson 8	pp. 44-48
SR		pp. 18-19

(201-7)

TR	Lesson 6	pp. 35-37
SR		p. 15
TR	Lesson 13	pp. 67-69
SR		pp. 28-29

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 for what it is used. 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

Student textbook module:
Down Under

(101-12)

TR	Lesson 14	pp. 72-76
SR		pp. 30-31

(203-1)

TR	Lesson 14	pp. 75-76
SR		pp. 30-31

Grade 3
Physical Science:
Invisible Forces

UNIT OVERVIEW

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 very dry.

Science Curriculum Links

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

Curriculum Outcomes

STSE/Knowledge

Students will be expected to

102-14 identify familiar uses of magnets

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

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

100-33 identify conditions that affect the force of magnets and of static electric materials

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

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

Skills

Students will be expected to

Initiating and Planning

200-2 identify problems to be solved

200-3 make predictions, based on an observed pattern

Performing and Recording

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

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

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

Analyzing 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

Magnetic Forces

Outcomes	Elaboration–Strategies for Learning and Teaching
Students will be expected to	
• identify familiar uses of magnets (102-14)	Students should investigate what magnets are used for. Bar magnets and horseshoe magnets can be explored to determine which objects are attracted to magnets and which are not. When students hold magnets together, they will very quickly discover that sometimes magnets attract, while other times they repel. **Caution: Do not allow students to hold magnets near computers, computer discs, or television sets.**
• 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)	Student will, in all probability, be familiar with the "magic" of magnets from toys, refrigerator magnets, and other devices. Magnetic devices such as these, as well as some standard 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. Early in their explorations, in response to questions or observations that they make, introduce the terms "magnetic force", "attract", "repel", "north pole" and "south pole".
• investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel (100-32)	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 in which the poles are marked can be used so that students can see that opposite poles attract, while like poles repel. Using this knowledge, they can use the marked bar magnets to determine where the north and south poles are located on unmarked magnets.
• identify problems to be solved related to magnetizing materials (200-2)	Problems could include identifying which materials can be magnetized or determining how can the magnetic strength be increased in these materials. 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 stay together after the magnet has been removed. These situations can lead to discussions and investigations into the strength of magents and how to magentize 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 ot see if they can make them magentic and try to make their weaker magnets stronger.
• 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)	Students can follow a procedure where they select an iron nail, a magnet, and some staples. They can be instructed to stroke the nail 5 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.

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 tests to find out which end is the north pole. Write up and draw observations and inferences. (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. (200-2)

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 this nail a stronger magnet? How can you make it weaker? (201-1)

Resources

Student textbook module:
Invisible Power

(102-14)
TR Lesson 2 pp. 17-22
SR pp. 6-7
TR Lesson 7 pp. 47-50
SR pp. 16-17

(100-31, 202-2)
TR Lesson 2 pp. 17-20, 22
SR pp. 6-7
TR Lesson 3 pp. 23-28
SR pp. 8-9
TR Lesson 5 pp. 34-40
SR pp. 12-13

(100-32)
TR Lesson 6 pp. 41-46
SR pp. 14-15
TR Lesson 8 pp. 51-57
SR pp. 18-19

(200-2)
TR Lesson 4 pp. 32-33
SR pp. 10-11

(201-1)
TR Lesson 5 pp. 34-40
SR pp. 12-13

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 (100-33)
- use the observations to identify conditions that affect the force of magnets (201-5) Include:
  - (i) strength of magnet
  - (ii) distance between object and magnet
  - (iii) material between object and magnet
- propose answers to questions raised related to magnetizing materials (202-7)
- 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 should 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.

Students can identify places in their lives where magnets are used on a regular basis. They can make a simple toy or device that has a magnet on it and experiment with making it move using other magnets. Some students will choose to move their toys using attractive force, while others may use repulsion to get a better motion. Encourage them to work together, look at their options, and test out various ways of getting their 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

Student textbook module:
Invisible Power

(200-3)
TR Lesson 4 pp. 29-31
SR pp. 10-11

(100-33, 201-5)
TR Lesson 4 pp. 29-31
SR p. 10
TR Lesson 5 pp. 34-40
SR pp. 12-13
TR Lesson 8 pp. 51-57
SR pp. 18-19

(202-7)
TR Lesson 4 pp. 30-31
SR pp. 10-11
TR Lesson 9 pp. 58-62
SR pp. 20-21

(201-3, 202-8, 203-5)
TR Lesson 14 pp. 84-86
SR pp. 30-31

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) Include:

  (i) strength of charge

  (ii) distance

  (iii) material used

Elaboration–Strategies for Learning and Teaching

This unit is best done in the winter when the air can be dry. Students can start their explorations of static charges by rubbing a variety of materials together, and seeing if the materials will then attract other objects, such as puffed rice, confetti, suspended pith balls or balloons, or any other objects they may wish to test.

They should then be encouraged to do a more formal study of these interactions by recording which pairs of materials produce evidence of a charge when rubbed together.

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. They can also rub a balloon with one piece of material (e.g., fur), and then rub other pairs of different materials together (e.g., corron and glass), 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, and see if this changes the original attraction or repulsion they experienced. Students can make and record their observations and draw simple conclusions such as "some things cause more static".

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 both will 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.

After their experiences with the magnets, students will be ready to investigate conditions that affect the strength of static electricity, but this time they will use test items such as puffed rice or confetti, and count how many of these are attracted under different conditions. They can try conditions such as the aount of rubbing or the rype of material that it is rubbed with.

Electrostatic Forces (Forces arising from Static Electricity)

Tasks for Instruction and/or Assessment

Performance

- Working in groups of two–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 with	# 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

Student textbook module:
Invisible Power

(101-8, 203-3)

TR	Lesson 10	pp. 64-68
SR		pp. 22-23
TR	Lesson 11	pp. 69-73
SR		pp. 24-25

(202-7)

TR	Lesson 10	pp. 64-68
SR		pp. 22-23
TR	Lesson 11	pp. 69-73
SR		pp. 24-25

(100-33, 201-5, 202-7)

TR	Lesson 10	pp. 64-68
SR		pp. 22-23
TR	Lesson 12	pp. 74-78
SR		pp. 26-27

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

Outcomes

Students will be expected to

- discuss 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) Include:
  - (i) effects- finger burn, static cling
  - (ii) avoiding static electricity- moisten objects, grounding

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 cling 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. (202-9)

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

Student textbook module:
Invisible Power

(202-9)

TR	Lesson 10	pp. 67-68
SR		pp. 22-23

(102-15)

TR	Lesson 13	pp. 79-83
SR		pp. 28-29

Grade 3
Physical Science:
Materials and Structures

UNIT OVERVIEW

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 be 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 give them the design skills necessary for the grade 6 unit, Flight.

Curriculum Outcomes

STSE/Knowledge

Students will be expected to

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

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

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

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

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

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

Skills

Students will be expected to

Initiating and Planning

200-2 identify problems to be solved

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

Performing and Recording

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

201-2 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

Proposing Solutions to Building Challenges

Outcomes

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) Include:
  - (i) strength
  - (ii) mass
  - (iii) ability to be joined

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

Elaborations–Strategies for Learning and Teaching

In the initial stage of the design process, students are given a challenge that requires them to build a structure out of materials. During the design process, students will encounter many problems (e.g., which materials to select, how to join them) that they will have to solve. Before the actual construction phase starts, students should focus on selecting the appropriate materials and designing a structure for the task. 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.

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

Students can also explore ways of joining materials. This would involve 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™.

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 of the materials being tested and let the glue dry. Test the glue by counting the number of pennies that can be supported on the join (or the number of paper clips that can be supported). (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 for which it is most suited. (100-34)

Interview

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

Material	Structure
cement	houses
wood	sidewalks
plastic	toys
etc.	*etc.*

Resources

Student textbook module:
Build It Up

(202-2)

TR	Lesson 4	pp. 25-30
SR		pp. 10-11
TR	Lesson 5	pp. 31-37
SR		pp. 12-13
TR	Lesson 8	pp. 50-53
SR		pp. 18-19
TR	Lesson 10	pp. 58-61
SR		pp. 22-23
TR	Lesson 12	pp. 66-69

(100-34)

TR	Lesson 2	pp. 16-20
SR		pp. 6-7
TR	Lesson 4	pp. 25-30
SR		pp. 10-11
TR	Lesson 8	pp. 50-57
SR		pp. 18-19

(101-11)

TR	Lesson 9	pp. 54-57
SR		pp. 20-21

Proposed Solutions to Building Challenges (continued)

Outcomes	Elaborations–Strategies for Learning and Teaching
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) Include: (i) arch (or dome) (ii) triangle (iii) square (post and beam)	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, for example, bird nests or beaver lodges. Once students have investigated various materials and ways of joining them, they can group them based on the function they could serve (e.g., strength, flexibility) and their suitability for the intended task.
• identify materials that could be used to solve the problem posed while creating structures and suggest a plan for how they will be used (200-5)	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 think critically about how to best use a limited amount of material.
- draw a rough sketch (blueprint) of their structure	Ask students to 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)
- 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

- 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

Student textbook module:
Build It Up

(102-16)

TR	Lesson 3	pp. 21-24
SR		pp. 8-9
TR	Lesson 5	pp. 31-37
SR		pp. 12-13
TR	Lesson 7	pp. 43-44
SR		pp. 16-17

(200-5)

TR	Lesson 4	pp. 27-30
SR		pp. 10-11
TR	Lesson 6	p. 41
TR	Lesson 8	pp. 51-53, 56
SR		pp. 18-19
TR	Lesson 12	p. 71
TR	Lesson 13	pp. 73-74
SR		pp. 28-29

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. 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 plan 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 "dinky" 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 were... 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

Student textbook module:
Build It Up

(101-10, 201-3)

TR	Lesson 11	pp. 62-65
SR		pp. 24-25
AG		p. 123

(201-8)

TR	Lesson 11	pp. 62-64
SR		pp. 24-25

(201-6)

TR	Lesson 6	pp. 36-38
SR		pp. 14-15

(201-2)

TR	Lesson 10	pp. 58-61
SR		pp. 22-23

(203-5)

TR	Lesson 13	pp. 72-74
SR		pp. 28-29

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 structure and its components (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)

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

Student textbook module:
Build It Up
(101-9, 202-8)

(202-5)

TR	Lesson 8	pp. 50-53
SR		pp. 18-19

(102-17)

TR	Lesson 7	pp. 43-45
SR		pp. 16-17
TR	Lesson 14	pp. 75-77
SR		pp. 30-31

(203-3, 203-2)

TR	Lesson 5	pp. 31-35
	Lesson 9	pp. 54-57
	Lesson 10	pp. 58-61
SR		pp. 22-23
TR	Lesson 14	pp. 75-80
SR		pp. 30-31