Science 3

Guide

NOVA SCOTIA
NOUVELLE-ÉCOSSE

2019

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Science 3

Prepared by the Department of Education and Early Childhood Development

This is the most recent version of the current curriculum materials as used by teachers in Nova Scotia.

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Curriculum Guide

2019

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- Investigate how water interacts with soil in the environment (COM, CT, TF)
- Classify soil samples (COM, CI, CT)
- Analyse the interconnectiveness of soil, living things, and the environment (CZ, COM, CI, CT, PCD)

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Indicators:

- Investigate how various plant parts change over the life cycle (COM, CT, TF)
- Investigate factors that affect plant growth (COM,, CT, TF)
- Investigate the interconnectiveness of plants, living things, and the environment (CZ, COM, PCD, CT)
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- Evaluate potential materials for use in construction (COM, CT, PCD, TF)
- Investigate ways that materials are joined during construction (COM, CI, CT, PCD, TF)
- Evaluate the structure according to design challenge criteria (COM, CT, TF)

Learners will analyse soil in the environment

Background

An investigation of soil will lead learners to the discovery that soil is an environment for many living things. By examining soils, learners discover that soils are made up of more than one type of substance and that the particular combination of materials in soil has an impact on the types of organisms that can live in the soil. A focus on the ways in which soil can be altered, especially changes that occur as a result of water, leads learners to discover how soil is impacted by humans and the environment. Learners will have opportunities to observe, manipulate, and test various soil samples to explore their composition, water absorption, drainage, and erosion.

Indicators

- Investigate the properties of soil (COM, CT, TF)
- Investigate how water interacts with soil in the environment (COM, CT, TF)
- Classify soil samples (COM, CI, CT)
- Analyse the interconnectiveness of soil, living things, and the environment (CZ, COM, CI, CT, PCD)

Concepts (and Guiding Questions)

Properties of soil

- How do soils from different areas compare?
- How do soil characteristics change when digging down deeper into the earth?

Soil separation

- How can I separate soil into its component parts?
- How does separating the soil into its component parts help with soil classification?
- How do the component parts that make up soil differ in samples from various areas?

Erosion, water absorption and drainage

- How much water do different soil types hold?
- How do rain and moving water affect various soil types?

Soil as an environment for living things (interconnectiveness)

- How do the types of organisms differ in samples from various areas?
- How do the living organisms found in the soil differ as I dig down into the soil?
- How is soil important?

Skills

Analyse

Gather and select appropriate information. Consider the appropriateness of information. Communicate findings.

Investigate

Ask questions; locate several details to support an answer; organize and compare details; communicate findings.

Classify

Identify attributes and select criteria for groupings; sort based on selected criteria and reflect on the grouping (s); incorporate a new item in a group, begin to offer a Rationale for the choice.

Elaborations—Strategies for Learning and Teaching

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

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

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

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

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

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

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

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

Students can practice their graphing with both of these activities.

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

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

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

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

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

Investigations will focus on the following:

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

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

Where appropriate, have students observe in a natural setting.

Students can investigate plant roots and describe how they spread through the soil. They can place a moist paper towel around the inside of a glass jar or plastic bag, put some soil in centre, and place popcorn (unpopped) between the glass and paper towel. Popcorn will sprout, and roots and leaves will be visible to observe.

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

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

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

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

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

Tasks for Instruction and/or Assessment

- Take your soil sample, put it in a clear plastic container, and add water until it is three-quarters full. Put the lid on, and shake it. Watch the contents settle.
- Predict what kinds of layers you are going to have after your soil sample settles. As you watch the particles settle, do you notice any patterns?
- Let the container settle overnight. Draw a picture of the settled soil in the container in your science log.

- Compare your soil sample composition with that of other classmates.
- Using different sizes of screening materials (chicken wire, colander, flour sieve), separate your soil sample into different piles, one for each screening material.
- Describe the materials in each of your piles. Are all the types of particles the same, or are they different? Compare the sizes of the piles that you have made. Measurements can be displayed as a bar graph.
- Complete the chart as you investigate the effect of water on different soil types.
- Put four or five small holes (using the size of a skewer) in the bottom of a Styrofoam cup. Put 125 mL of soil in the cup.
- Hold it over another Styrofoam cup, and pour 125 mL of water over the soil. Measure the amount of water that drips out. Record your results.Compare your results to your classmates for different types of soils, and draw a bar chart to display class results.
- Take a soil sample with different particle sizes in it. Put it in a cake pan and pour 250 mL of water on top of it. What happens to the soil? Do you notice any difference between the types of particles that were washed away and the ones that stayed?
- 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?
- Record your observations and describe the effects of moving water on different types of soil. Label your drawing and write a description to go with it.
- Take some soil and put it in a clear container. Pack the soil down fairly tightly. Put three or four worms on top of this soil and observe the worms periodically throughout the next couple of days. What happens to the soil over the two days? In what way are worms good for soil?
- Put some potting soil in a small, clear plastic cup. Plant some seeds and care for them as they germinate and grow. Look for evidence of the roots through the cup and draw what you observe. What role does soil have for the functioning of roots?

Learners will investigate plants in the environment

Background

Learners will engage in careful observation of how plants grow and respond to their natural environment which will reveal patterns of growth. Learners will investigate how various conditions affect plant growth and they will explore and compare the life cycles of various plants. The interconnectedness between plants, the environment, and humans will be explored as well as the cultural importance of plants.

Indicators

- Investigate how various plant parts change over the life cycle (COM, CT, TF)
- Investigate factors that affect plant growth (COM,, CT, TF)
- Investigate the interconnectiveness of plants, living things, and the environment (CZ, COM, PCD, CT)
- Investigate the uses of plants, including plants as medicine (CZ, COM, CT, PCD, TF)

Concepts (and Guiding Questions)

Life cycles of various plants

- How do the functions of various plants parts compare?
- How do various plant parts change over the life cycle?
- How are roots important for healthy plants?
- How do plants make more plants?

Factors that affect plant growth

- How do the optimal conditions for plant growth compare for various types of plants?
- How do various factors alter the growth of roots, stems and leaves?

Interconnectiveness of plants, humans and the environment

- How are plants important for humans?
- How can we take care of plants and the environment?

Plants as medicine

- How are plants used?
- How are plants used as medicines?

Skills

Investigate

Ask questions; locate several details to support an answer; organize and compare details; communicate findings.

Elaborations—Strategies for Learning and Teaching

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.

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.

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

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

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

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

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

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

Students should grow flowering plants or have an opportunity to observe flowering plants over a long period of time (such as marigolds, bulbs). Students can plant seeds in a container that will allow a view of the seed as it germinates. Consider using a paper towel-lined glass jar with soil in centre or a plastic bag taped to the window. As the seed germinates, the students can unfold the paper towel to track the seed’s progress. Students can use drawings to record their observations of the plant’s life cycle, estimate the length of various parts of the plant (for example, leaf size, root length, height), and take measurements.

Students can record their measurements in charts and graphs. Students can observe the bloom using a magnifying glass or Intel Microscope. The whole sequence of plant growth (germination, sprouting, buds forming, flowering, pollination, fruit/seed growth) can be observed. The newly formed seeds can then be

potted to continue their cycle back to seeds. Students may explore other ways to grow plants (from clippings, bulbs, or the eye of a potato).

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

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

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

Students can focus on the following:

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

Art and decoration: Students can collect local wildflowers, and practice arranging them, drying them, and making a variety of craft items using them.

Medicines (for example, garlic, ginseng): Students can interview people in their community to find out natural remedies using specific plants and make a poster or collage to illustrate their findings.

Dyes (for example, beet [red], blueberries [blue], onions [yellow]): Students can tie-dye white T-shirts using the dyes from local plants.

Fibres (for example, cotton, straw used in baskets, cellulose or tree fibres used in making paper, onion skins are used for paper): Students can make paper, do some basket weaving, or bring in clothes made from cotton.

Providing oxygen: Animals need oxygen to breathe. Plants produce oxygen and also can filter impurities from the air. Students can plant trees around the school yard as a naturalization project.

Preventing erosion (e.g., cross-slope plowing in farming): Look in the grade 3 Exploring Soils unit for activities related to this use.

Building materials: Students can look at the wide variety of wood products that are made from the trunks of trees (e.g., plywood, lumber, paneling). If possible, students can visit a local sawmill to see how trees are processed into lumber.

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

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

- the produce section of the grocery store
- farm
- florist
- seashore
- a factory that processes fruit, vegetables, flowers, or trees
- recycling plant

Students can interview people with careers that involve plants as well as elders who can share stories of plant uses.

Tasks for Instruction and/or Assessment

- Provide students with several types of seeds. From all of the seeds you have been given, decide on a way to group them. State your rule for sorting.
- Test various conditions for growing plants. When you are finished, construct a bar chart to show the plant's growth. From the list, students have generated, various groups can select the variables they wish to investigate. Results can be shared with the class.
- Journal prompt: I would like to find out if ... can make my plant grow faster. I predict that ...
- What is the function of a plant's roots? (Teachers can question about other plant parts throughout this unit.)
- Draw pictures of the plants in your class that grew under different conditions. Which plants grew best? How do you know?
- Draw pictures that record observations at the different stages (germination, sprouting, buds forming, flowering, pollination, fruit/seed growth) of a flowering plant you are growing.
- Using your plant data, construct an appropriate graph. Include a chart and a diagram.
- Journal prompt: Describe ways in which plants are important to humans and all living organisms.
- Classify food items according to the plant part used.
- Create a video, dramatic, or pictorial representation on human uses of plants.
- What can you do to replenish plants in our environment? How does the natural world benefit from this action?

Learners will investigate invisible forces

Background

This outcome will introduce learners to two kinds of forces that can act between objects when the objects are not touching, magnetic and electrostatic. Some forces involve direct pushes and pulls, where a surface is directly contacted, while others involve interaction at a distance. Through investigations, learners will discover that magnetic forces and static electric forces involve attraction and repulsion and that they act on different types of materials. Learners will explore how these forces can affect their everyday lives. Investigations of invisible forces presents an opportunity to practice skills such as data collection, data recording and data analysis as well as the skills of prediction and hypothesis creation.

Indicators

- Investigate electrostatic forces (COM, CT, TF)
- Investigate magnetic forces (COM, CT, TF)
- Investigate factors that affect magnet strength (COM, CT, TF)

Concepts (and Guiding Questions)

Static electricity

- How can various materials be charged with static electricity?
- How can we make the biggest static charge?

Magnetic forces

- How can I make a magnet?
- How are various materials affected by magnets?

Factors that affect the strength of a magnet

- How can I measure the strength of a magnet?
- How can a magnet be made stronger?

Skills

Investigate

- Ask questions; locate several details to support an answer; organize and compare details; communicate findings.

Elaborations—Strategies for Learning and Teaching

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

Students can follow a procedure where they select an iron nail, a magnet, and some staples and are instructed to stroke the nail five times in the same direction using the same end of the magnet. They can

then put the iron nail into the staples and record the number of staples attracted. They can then repeat this procedure a number of times and test and record the number of staples that are attracted. Students need to be shown the proper way to handle and store magnets. Magnets gradually lose their strength if they are dropped repeatedly or stored improperly.

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

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

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

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

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

Students can start their explorations of static charges by rubbing a variety of materials together and seeing if the materials will then attract other objects, such as puffed rice, confetti, suspended pith balls or balloons, or any other objects they may wish to test. Students can observe attraction and repulsion caused by static electricity using materials such as suspended balloons, fur, water, combs, and confetti. Students can rub two balloons with the same material (cotton, fur, or wool) and explore how the balloons interact, then record their results. They can also rub a balloon with one piece of material (e.g., fur), then rub other pairs of different materials together, and note how the suspended balloon interacts with each of these other materials. For each pair of materials, the balloon should be attracted to one and repel the other. Students can also see what happens when a charged material (e.g., wool that has been rubbed) touches the balloons. Students can make and record their observations and draw simple conclusions such as “some things cause more static.”

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

it touches it, electrons will be transferred as they touch, so that both the balloon and the objects now hold the same charge and will repel each other.

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

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

Tasks for Instruction and/or Assessment

- Set up some tests to find out which end of a magnet is the north pole. Write up and draw observations and inferences.
- In your home, look for ways in which magnets are used. Share your findings with the class
- Journal prompt: Today I learned about magnets ... (Look for words like attract, repel, north, and south in the students' descriptions of what they learned.)
- Ask: How can you magnetize an iron nail? How can you prove that it has become magnetized?
- Are all metals attracted to magnets?
- How can you make this nail a stronger magnet? How can you make it weaker?
- Use magnets and the materials provided to make a toy that you can move around. For example, a robot that can climb walls; a car that can be controlled
- Investigate the factors that you think might affect the strength of a magnetic force.
- Share and demonstrate to the class the magnetic toy that you made. Explain how it works, using terms like attract and repel and/or pull and push.
- 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.
- 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.)
- Describe what you know about static electricity and carpeted floors.
- Describe what happens when your clothes come out of the dryer. How do you think this is related to static cling?

Learners will construct a structure in response to a design challenge

Background

By taking part in the problem solving process to address a challenge, learners will discover that the characteristics of the structures they build, such as their strength, are linked to the properties of the materials they use and to the particular way the materials are configured and joined. Learners will test and evaluate their structures based on design challenge criteria; they will be challenged to refine their designs as appropriate. The testing of structures allows for exploration of the idea of a fair test which provides the foundation for the scientific concept of control of variables. Testing and the design process will also provide opportunities to practice skills of measurement and data analysis.

Indicators

- Investigate shapes in structures (COM, PCD, CT, TF)
- Evaluate potential materials for use in construction (COM, CT, PCD, TF)
- Investigate ways that materials are joined during construction (COM, CI, CT, PCD, TF)
- Evaluate the structure according to design challenge criteria (COM, CT, TF)

Concepts (and Guiding Questions)

Structural materials and their properties

- How do the materials that make up the various structures I see around me compare?
- How does the choice of materials affect the properties of the structure?

Structural shapes and their strength and stability

- How are various shapes used in the structures around me?
- How do the shapes used in construction affect the properties of the structure?

Ways to join materials

- How are materials joined in structures that I see around me?
- How does the way of joining materials in construction affect the properties of the structure?

Structure design

- How can I solve a design challenge?
- How can I tell if the structure I constructed met the design challenge?

Skills

Construct

- Identify a purpose; brainstorm ideas; identify a plan; gather and select information to support plan; build a model; test and revise, modify as necessary; reflect on the results

Investigate

- Ask questions; locate several details to support an answer; organize and compare details; communicate findings.

Evaluate

- Review steps and results from an investigation or problem solving. Reflect on and communicate alternative solutions or findings. Begin to identify potential new problems or issues.

Elaborations—Strategies for Learning and Teaching

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 able to propose solutions to the task or challenge.

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

Testing: Students will test and evaluate their designs, compare them to other students' designs, and refine their designs as appropriate. Students should be presented with several structural challenges or tasks that require the individuals or in small groups to complete the design technology cycle. These challenges should involve using a variety of materials, the acquisition of a variety of techniques for joining materials and improving the strength and stability of structures.

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

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

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

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

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

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

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

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

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

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

Students should be made aware of any important safety rules. Science safety is always appropriate to discuss with the students.

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

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

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

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

Tasks for Instruction and/or Assessment

- Make a list with the class of potential problems that might arise in building a structure.
- 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.)
- 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).
- Journal prompt: 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 ...
- Match materials with the structure it is most suited for.
- Look at buildings and structures for one week. Keep track of shapes (e.g., rectangles, triangles) and structures (e.g., arches, columns) that you see. Use a digital camera or other device to record the structures.
- Sketch the shapes of the buildings and structures. Comment in your science log on their shapes, strength, stability, and/or balance.
- Ask: Which type of materials are you planning on using for your structure? What makes these materials good choices?
- 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.
- Safely build the structure based on your plan of materials and how you are going to join them. As you work on your structure, talk with your partner about any problems you have and adjust your plan based on your discussions.
- Design a bridge that allows two-way "dinkie" traffic. It should be strong enough to hold 10 cars at a time, must be able to span a distance of 50 cm, and must be 10 cm off the ground.
- Design a tower that is 20 cm high and must be capable of holding a paper (or plastic) cup with 15 marbles in it while a fan set on medium speed is blowing on it from 0.5 m away.
- Journal prompt: Problems that we had while building our structure were ... We solved them by ... (use drawings to explain)
- Test your structure to see if it can do what it was designed for. Identify ways that you could improve your structure.
- Present your structure to your classmates. Describe problems that you solved, changes you made, and your design strengths and weaknesses.

Appendix A
Experiences for Earth and Space Science: Exploring Soils

Activity 1: Investigating Soil

Assessment

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

Questions

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

Materials

Trowels
Soil
Magnifying glasses
Microscope
Toothpicks
Rubber gloves
Newspaper
Plastic
Books on soil

Procedure

It would be beneficial to have students go out in the schoolyard and collect their own soil samples where possible. Care should be taken so that students do not harm plants or animals. If an area is not available, soil samples should be brought in from home or a garden centre. Students should be given the option to wear rubber gloves when handling soil.
Have students pour out their soil samples on the newspaper or plastic. Using magnifiers, have students look closely at the soil and record what they observe. (How does the soil feel? Does it have a smell? What does it look like?) Have the students sort through the soil. Have them illustrate what they observe. Have a group of students use a Microscope to have a closer look at the soil.
Discussions could take place on the importance of soil to plants and animals. Students should share hypotheses of what they think soil consists of.

Activity 2: Screening Your Soil

Assessment

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

Questions

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

Materials

Soil sample(s)
Various sizes of screening/mesh (from hardware or building supply stores)
Colander
Flour sieve
Soil sieves
Magnifiers
Microscope

Procedure

The purpose of this activity is for students to observe the various sizes of particles that make up a soil sample. Students should start with mesh/ screening with large openings and observe the soil. With the soil that has filtered through this, use the next size mesh and so on. After each time students should record observations with illustrations and descriptions in their science logs.
To make your own sieves, various sizes of mesh can be purchased at building supply or hardware stores. The mesh can be cut into 10 cm by 10 cm squares. The outer edges should be taped with masking tape or duct tape so that students do not cut themselves. The other option would be to purchase soil sieves from a scientific supply company.
Discuss with students their findings and leave time for students to share new questions that may arise as a result of their exploration.

Activity 3: Absorption of Water

Assessment	Students are able to predict and explain the reasons for their predictions. Students are able to measure amounts of soil and water using correct metric measurements (mL or L). Students are able to sort their samples in order of their ability to absorb water. Students are able to make appropriate bar graphs to represent their findings. Students are able to illustrate the results of their investigations.
Questions	Which soil sample absorbed the largest amount of water? How were you able to tell which soil sample absorbed the largest amount of water? Which metric units did you use to measure the amount of water absorbed by the soil?
Materials	Strainers with small holes (either made or purchased) Soil samples (sandy soil, gravely soil, potting soil, clay soil, etc.) Rubber gloves Plastic containers Safety glasses Hammers Nails Wood Metric measuring containers Graduated cylinders Balances Metric masses

Activity 4: Texture of Moistened Soil

Assessment

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

Questions

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

Materials

Soil samples (clay, sandy soil, loamy soil mixture of sand, silt, and clay)
Water
Metric measuring spoons
Medicine droppers

Procedure

A variety of soil samples may be purchased from a local gardening centre or taken from around the school; only a small amount (2 mL) needs to be used.
Have students describe the texture of each sample of soil prior to moistening it. Have them record how it felt and the properties it had (gritty, fine, would not hold together, rough, colour). Next, have the students add a drop or two of water to their soil samples. Have them describe their soil sample (colour, texture, how well it compacts, thickness, density).
Discuss with students how knowing the various properties of soil would help living things and farmers when deciding what types of plants to grow on their farm.
Teacher Note: Students should wash their hands after completing this activity.

Activity 5: Moving Water and Different Types of Soil

Assessment

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

Questions

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

Materials

Aluminum cake pans—one for each type of soil (perhaps from a dollar store)
Various types of soil (clay, sand, planting soil)
Water
Metric measuring containers for water and soil

Procedure

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

Activity 6: Moving Water/Soil/Plants

Assessment

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

Questions

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

Materials

Aluminum cake pans—one for each type of soil
Various types of soil (clay, sand, planting soil with grass planted and growing in/on it)
Water
Metric measuring containers for water and soil

Procedure

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

Appendix B
Experiences for Life Science: Plant Growth and Changes

Activity 7: Seeds

Assessment	Students are able to sort seeds using one or more attributes. Students are able to describe the various attributes of their seeds. Students are able to explain the reasons for their sorting method(s).
Questions	What do some or all of the seeds have in common? How do the sizes of the seeds vary? What types of plants do you think the seeds might come from?
Materials	Various types of seeds (these can either be brought in by the students or by the teacher) Sorting rings
Procedure	Give each group of students a variety of seeds to sort and sorting rings. Have each group explain their sorting rule(s). Have students draw the seeds and write a description beside the drawing. The description should include the properties of the seeds such as the texture, colour size, smell, shape, and so on. Discuss with the students what they think is the purpose(s) of seeds. Have them write their responses in their science logs or journals.

Activity 8: Conditions for Plant Growth

Assessment

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

Questions

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

Materials

Soil
Plants
Seeds
Materials as suggested by students

Procedure

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

Activity 9: How Well Is Your Plant Growing?

Assessment

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

Questions

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

Materials

Soil
Plants
Seeds (marigold, bean, pea, grass, etc.)
Measuring devices (rulers, metre sticks)
Plants

Procedure

This activity is designed to have students meet with success in growing plants. Proper planting soil should be used, and it should be the same for all students. If your school has a naturalization area, you may want to take your students to a garden centre or have someone from a garden centre come to your school and recommend the type of plants that should be planted. Students should look at the seed packets for the size of the plants, spacing, and germination period. This could be done as a class project, and students could take turns measuring their plants and have a class bar graph to record the growth. Students should have the option to grow a variety of plants. Students need to grow plants to watch them grow, watch what happens from too much or too little water, and see the cycle of plant growth.
Record relevant information. From this information the students would produce their own bar graphs. Discussions should take place regarding who would use the data on the growth of plants and how they would use it. Discussions should take place regarding the spacing of plants and how farmers use this knowledge when planting their crops.

Activity 10: Light and Plants

Assessment

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

Questions

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

Materials

Seeds (bean, marigold)
Plants
Soil
Containers to hold plants

Procedure

Students have had experiences with fair tests in previous grade levels. Review with students the term "fair test." Brainstorm with students what they think is the importance of light on the growth of plants. Record their answers on chart paper for future reference.
Tell students that they are now going to test their ideas. Have students develop a fair test for growing plants in various types of light.
Guide students to consider that

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

Have students plant their seeds and put them in various types of light: dark cupboard, under fluorescent lights, under a grow light (a grow light is a special type of fluorescent light used for plant growth), in sunlight, under an incandescent bulb, etc. Have students record their observations. Discuss with students their findings. Relate what they learned in class to real-life situations (greenhouses, plants in malls, plants in gardens, etc.).

Appendix C
Experiences for Physical Science: Invisible Forces

Activity 11: Pulling Together

Assessment	Students are able to sort materials that are attracted by magnets and those that are not. Students are able to record their findings.
Questions	Which materials were attracted to magnets? Which materials were not attracted to magnets? What characteristics did the materials attracted to the magnets have in common? What characteristics did the materials that were not attracted to the magnets have in common?
Materials	Bar magnets A variety of materials that students can use to see if they attract to magnets or not (e.g., cloth, plastic, paper, nails, paper clips, aluminum foil, pennies)
Procedure	Brainstorm with students the term attraction. Write a workable definition of the term on chart paper or on the board from the students' responses. Give the students a variety of materials to see if they are attracted to magnets or not. Have them sort them using attribute rings (attracts to magnets, does not attract to magnets). Have the students record their findings. Discuss with students their observations. Use the questions outlined above to lead the discussions.

Activity 12: Making a Magnet

Assessment

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

Questions

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

Materials

Strong magnets
Pins and/or iron nails
Staples

Procedure

Review with students what they learned in the learning experience, Pulling Together. Ask students which materials they would use to try to make a magnet. Provide students with materials. Challenge the students to try to make their nail or pin magnetized.
Have them record how they were able to do it and any problems they might have encountered. Have students share how they made their magnets and record their methods on chart paper or on the board for future reference.
Next, discuss with students ways in which they could make their temporary magnets stronger. Tell students that they need to stroke their nails or pins in the same direction using the same end of the magnet.
Have them experiment to see if the number of times they stroke the nail or pin on the magnet increases the strength of the temporary magnet. Have them record their results in a chart in their science logs.

Activity 13: Strength of a Magnet

Assessment	Students are able to predict and observe the impact of different conditions on the strength of a magnet. Students are able to convey their results both verbally and in written format.
Questions	What did you observe happened to the ability of the magnet to pick up objects through different substances? What happened to the strength of the magnet when you tried to pick up objects through different materials?
Materials	Ceramic, bar, or wand magnets Items to be picked up (paper clips, staples, finishing nails) Various materials (cloth, wood, aluminum foil) to see if the magnetic force is affected by them
Procedure	Have students predict what they think would happen to the strength of a magnet if it had to pick up objects through another material. Give students a variety of materials to see what impact they have on the strength of a magnet. For example, have the students use a magnet to see how many paper clips it can pick up. Then have them use the same magnet and hold it on a desktop and see how many paper clips it can hold through the desktop by placing the paper clips on the other side. Ask students to share their ideas, and have the class try them out. Have students record their findings. Discuss as a class what they observed and any questions that may have arisen as a result of this experiment.

Activity 14: Using Magnetism

Assessment	Students are able to use their knowledge of magnetism to make a toy or game.
Questions	How could you use the properties of magnetism that you have learned to build a toy or game?
Materials	Various types of magnets Materials students need to build a toy or game
Procedure	Ask students to use the magnets provided to build a toy or game using various materials. Some suggestions might be a hockey game (where the players have washers as their base and a magnet is used to move them), golf (where the golfer is set on a washer and a magnet is used to push the golfer into the ball to make it go in a hole) or a car that moves by magnets. Have students make drawings of their games/toys and do a brief write- up explaining how they made it, problems encountered, how they solved the problems, and how the game/toy works. Students should be given the opportunity to share their ideas with the class.

Activity 15: Static Electricity—Attract/Repel

Assessment	Students are able to demonstrate materials attracting and repelling each other. Students are able to illustrate and explain what happened when objects attract or repel each other.
Questions	What happened when a statically charged material came in contact with another object (piece of material)? Do the materials react the same way each time? Tell what happened.
Materials	A variety of materials (cotton, wool, polyester, plastic, wood, aluminum foil) Straws Puffed rice Pith balls String
Procedure	Hang puffed rice or pith balls by string over the edge of a desk. Give each group of students a variety of materials and a straw. Have the students rub the material against the straw and move the straw towards the hanging puffed rice or pith ball. Have them observe and record what they observed. After the students have completed the activity, discuss with them their results. This water activity can be either teacher demonstrated or sent home to complete. Run a slow stream of water from a water tap. Bring a statically charged object close to it. Watch how the water moves.

Activity 16: What Is Static Electricity?

Assessment	Students are able to demonstrate static electricity. Students are able to give examples of where static electricity can be found.
Questions	What happened to the balloon when you rubbed it on your hair and placed it on a wall? What materials create static electric charges?
Materials	Balloons A variety of cloth Straws Plastic
Procedure	Brainstorm with students what they think the term “static electric charges” means. Have them give examples of where they have seen or felt static electricity. Give the students a variety of materials and have them try to create static electric charges; for example, rubbing a balloon on their hair and having it stick to the wall. Do students know any other methods? Illustrate and record findings. Discuss with the students how they knew they had created a static electric charge.

Activity 17: The Strength of Static Electricity

Assessment

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

Questions

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

Materials

Paper
Ticket board
Wood (desk top)
Aluminum foil
Balloons
Straws
Various types of material (cloth, plastic, paper)
Puffed rice
Clear plastic cup
Water

Procedure

Discuss with students whether they think a static charge is able to go through an object/substance. Ask students how they would go about investigating their ideas. Put their suggestions for investigations on the board or chart paper. Give the students a balloon, straw, and materials to carry out their investigations.
Example: Have students put a piece of string or puffed rice on a sheet of paper. Put the charged material under the paper. Are you able to move the puffed rice or string as they move the charged object. Record the results.
Next, have students see if a static charge is able to pass through water. Let students share their observations.

Appendix D
Experiences for Physical Science: Materials and Structures

Activity 18: Use of Materials

Assessment

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

Questions

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

Materials

An assortment of materials which could include the following:

- Popsicle sticks
- pieces of wood
- cotton balls
- toothpicks
- straws
- newspaper
- pipe cleaners

Procedure

Give each group of students a variety of materials. Ask students to describe and name the materials and then decide what types of objects could be built with the materials. Next, have students think about how they might be used and who or what might use them. Prompt the students to investigate how to make the materials more sturdy. Ask, “How would you be able to make paper stronger?” Have students try their ideas. This can be related to how animals adapt materials to make them useful to them.

Activity 19: My Fasteners and Their Uses

Assessment

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

Questions

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

Materials

A variety of fasteners
Various types of glue
Paperclips
Bulldog clips
Brass fasteners
Velcro
Snaps
Rope
Twine
A variety of screws
A variety of nails
Needles
Safety pins
String
Thread

Procedure

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

Activity 20: Structures and Shapes

Assessment	Students are able to identify various geometric shapes in both natural and human-built environments. Students are able to identify shapes that would provide stability, strength, or balance through exploration. Students are able to illustrate and record their findings from the explorations carried out.
Questions	How do animals use stability, strength, or balance in building their structures? What and where were you able to find shapes in human-built structures within your community? What geometric shapes would you use if you were building a tower?
Materials	Pictures of towers (these can be found using the Internet or in books) Pictures of various structures built by animals (these can be found using the Internet or in books)
Procedure	Take the students on a walk around the community. Have them record structures that they see and make notes on what they think makes them strong, stable, or balanced. Have students record any geometric shapes they might see that are used to make the structure strong, stable, or balanced. As a class discuss what the students observed. Have pictures of structures made by animals or by humans available for students to discuss and explore. Ask students to record their observations and discuss as a class.

Activity 21: A Building Challenge

Assessment	Students are able to decide on a structure they would like to build. Students are able to follow their design and make improvements, as necessary. Students are able to decide on the materials needed to make their structure.
Questions	How will you decide on the structure you want to build? What materials will you need to build your structure? What steps will you follow to make your structure? What steps will you use to solve any problems that might arise?
Materials	Books for students to use as references to decide on the structure they want to build
Procedure	In this activity, students are to decide on their own structure and following the design process as indicated from the outcomes above and suggestions in the guide.