Science 2

Guide

NOVA SCOTIA
NOUVELLE-ÉCOSSE

2019

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Science 2

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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Learners will analyse the interconnectiveness of air and water in the environment, inclusive of a Mi'kmaw perspective

Background

With this outcome, learners will explore the characteristics of air and water and their interconnectivity. Much of the science investigation to date has been of concrete objects; in contrast, gases are sometimes only visible through their effects. Through investigations, learners will explore changes and interactions of air and water when they are heated or cooled, as well as their movement through the environment. This will lead to an exploration of evaporation and condensation. Learners will have multiple opportunities to collect, record, and analyse data. Learners will discover that water and air are vitally important and gain an understanding how pollution can affect living things.

Indicators

- Investigate the effect of temperature on the movement of air (COM, CT, TF)
- Investigate the relationship between air and water (COM, CT, TF)
- Investigate the interconnectiveness of Mi'kmaw people, air and water (CZ, COM, CT)
- Analyse how personal actions can contribute to healthy air and water (CZ, COM, CI, CT, PCD)

Concepts (and Guiding Questions)

Temperature affects the movement of air

- How can I show that air is a real substance if I can't see it?
- How can I tell that air takes up space?
- How does warm air move?
- How can I move an object using only air?

Evaporation and condensation

- How can I find evidence of moisture in the environment?
- How does water form on the outside of a cold glass?
- How can I determine where the water from a puddle goes when it is sunny?
- How can I create an instrument to measure the amount of rainfall?

Interconnective relationship of Mi'kmaw people with air and water

- How are air and water important to Mi'kmaw people?
- How can we keep water clean?

Personal actions can contribute to a healthy environment

- How is water important to me?
- How can I keep the environment healthy?

Skills

Analyse

Gather and select information. Begin to consider appropriateness of information. Communicate findings.

Investigate

Ask a question; locate several details to support an answer; organize details to compare choices; communicate findings

Elaborations—Strategies for Learning and Teaching

The focus in this unit is on inquiry. Students are presented with many opportunities to explore the interconnectiveness of air and water, and how temperature and moving air can affect the form of water. They also are provided with opportunities to test fabrics to see how suitable they are for various weather conditions. Finally, they gain an appreciation for having a clean water supply and investigate how water pollution can affect living things as well as how personal actions can contribute to a healthy environment.

There is an interconnective relationship between Mi'kmaw people and air and water. Sharing stories is an effective way to explore this relationship. Students can also explore their personal relationships with air and water.

Students can explore how air takes up space by trying to fill up empty bottles (plastic) with water by holding the bottles under water in a tub or bucket. Structure the activity so that they attempt to fill up the bottles by holding the bottles in different positions under water (opening down, sideways, up). Alternatively, students can be given bottles with paper towels in the bottom and asked to submerge the bottle without getting the towel wet.

Many familiar technological products (balloons, tires, and air mattresses) can be used to illustrate that air takes up space. Students can inflate some of these products and manipulate them with their hands to feel the air that has been trapped inside.

Air is invisible. As such, students can only see and feel evidence of air in order to gain an understanding that it is an actual substance.

In classroom discussion, students can be given the opportunity to think about the reasons or explanations that the bottles will not fill up with water if they are held upside down. They can also think about what may be in the bubbles they saw as the bottles did start to fill up. Encourage students to respond to other students' ideas. Students can use what they have learned as they race to see who can fill up the bottle fastest, then share their techniques with other students. They can also explore the fastest method to empty the water from a bottle. Students may think holding the bottle upside down is the fastest way to let water out, but it will pour out more quickly if air is allowed to get in by tipping or swirling the bottle.

Have students observe how air feels when there is wind. Involve students in activities where they can feel moving air (for example, letting the air out of balloons or tires; standing in front of a fan; standing in the wind). Teachers can help students make a list of things that wind can do (for example, cause a flag to wave, blow down trees, move sailboats). Probe their conceptions of what it is they are feeling and introduce the idea of "too small to see, but it is there."

Students can construct weather vanes to measure the direction of the wind or make simple wind direction indicators using ribbons hanging from various places around the school and school grounds. They can use phrases like "It is blowing towards the tree," as well using terms like north, south, east, and west. They can use pinwheels to show how fast the wind is blowing.

Teachers may have demonstrated the use of thermometers in the unit Daily and Seasonal Changes in Science 1, but students did not use them or any standard units of measurement. In grade 2, students are being introduced to standard units of measurement in the math program (such as metres, litres), but they are not introduced to temperature units until later. Students would measure air temperature in various parts of the classroom (by a window, in the sun, by a space heater) with a thermometer to see if they can detect any changes in the height of the liquid in the thermometer.

Tasks for Instruction and/or Assessment

- Construct a wind speed indicator. Use it to measure the wind speed and direction at various locations and at different times.
- Today we did experiments with air. I learned lots of things ... I wonder about ...
- Prompt: How can you show me that air is a real substance when you cannot see it?
- Draw pictures to show how you know that
    - air takes up space
    - air can move things
- With a partner, describe how warm or cold it is at indoor and outdoor locations, and record your observations.
- Find a place outside near your school where you want to collect your weather measurements. Three times a day (for example, before recess, after lunch, and afternoon) for one week, record your observations (class activity).
- The things that I learned about the air conditions indoors are ... The things that I learned about outdoor air conditions are ...
- Observe student participation in activities.
    - ability to discuss/share their ideas
    - ability to design and conduct a fair test
    - ability to interpret and create charts, drawings, texts

- Tasks may include the following:
    - design an investigation that will control variables as they explore water evaporation/condensation
    - create an instrument for measuring the amount of rain/snowfall
    - create/interpret a chart that describes the changes that they have explored in their investigation
- Some of the places where I've discovered water are ...
- Make an instrument for measuring the amount of rain (or snow). Measure the amount of rain (snow) each day for two weeks and record your findings. When you are finished, construct a graph to show your results.
- Explore how to change moisture from one form to another, make observations (include all changes: such as water to water vapour, water vapour to water). When would you want materials to be absorbent? to be waterproof? to dry quickly?
- Predict which materials are more absorbent and give a plan to test your predictions.
- List your materials in order from least waterproof to most waterproof.
- Have students create an outfit out of materials tested for a specific weather condition or activity.
- What kinds of things do you or your family use to prepare for different weather conditions?
- Create a poster of products that are used to weatherproof things like clothing, houses, decks, and roads. Flyers and catalogues from hardware stores make a good source of pictures.

- Visit a local stream, river, seashore, or lake with your class. Look for signs that the water is healthy or signs that it is polluted. Record your observations.
- Write down some ways to try to make sure water is kept unpolluted. (Do not ignore the ocean.)
- Journal: How is water useful in my life? Some ways I can help keep water safe are ...
- Prompt: How do people get safe water? Does everyone get it the same way?
- Why is it important that our water be clean and not polluted?
- Create a poster or mural:
  - water sources (lakes, rivers, underground water, ocean)
  - ways of getting this water (wells, pumping stations, hand pumps)
  - how we use water
  - ways to make sure our water is pure and clean

Learners will analyse the relationship between animal growth and the environment

Background

Observing the growth and development of an individual organism can be a powerful learning experience, especially if the learner shares responsibility for its care. For example, learners can raise a butterfly from caterpillar to adult. The growth and development of the butterfly can then be compared to that of other animals and of themselves. This also provides an opportunity to investigate conditions for healthy growth of organisms. Learners will be challenged to make and record observations and to compare life cycles of various organisms. Learners will notice patterns of growth and how these patterns can be used to make predictions about different types of organisms.

Indicators

- Compare patterns of growth (COM, CT)
- Compare the life cycles of familiar animals (COM, CT, TF)
- Investigate conditions for healthy growth (COM, CT, TF)
- Analyse environments that support the health and growth of animals (CZ, COM, CI, CT)
- Investigate the interconnectiveness of animals and the environment (CZ, COM, CT, PCD)

Concepts (and Guiding Questions)

Patterns of growth

- How do plants change as they grow?
- How do I change as I grow up?

Life cycles of various animals

- How do plants make more plants?
- How do life cycles of various animals compare?

Conditions for healthy growth

- How do the needs of animals and plants change as they grow?
- How can I stay healthy?

There is an interconnectiveness between animals and the environment

- How can I design a home for my favourite organism?
- How can the environment hurt or help the growth of various organisms?

Skills

Analyse

Gather and select information. Begin to consider appropriateness of information. Communicate findings.

Compare

Make observations; identify similarities and differences; begin to offer an interpretation; reflect on the findings

Investigate

Ask a question; locate several details to support an answer; organize details to compare choices; communicate findings.

Elaborations—Strategies for Learning and Teaching

Students should investigate the life cycle of at least one type of organism first-hand. The selection of this organism could vary, depending on student and teacher interest, the availability of local organisms, any student or teacher allergies, and the availability of specialized classroom equipment such as incubators or refrigerator. Aquariums, jars, terrariums, or cages must be set up to hold the creatures for extended periods of time, so this unit should be started early in the school year when specimens may be more easily obtained, and students will get the chance to see as much of the life cycle as possible.

Students could describe changes in their pets, themselves or their siblings. They could notice that their pets or siblings have different needs as they change over time. Students should be encouraged to ask questions like "I wonder how long it takes a chicken to hatch?" "Do butterflies really come from caterpillars?" "Where do moths come from?" "Is a baby frog just like a grown-up frog?" These questions can form the basis for exploration, and students will undoubtedly ask many more as the investigations proceed. Guide the discussion by introducing other organisms like butterflies, fish, chicks, frogs, or meal worms that they will be able to observe and investigate. Do you know how living organisms grow and change? What types of things would you think would be worth investigating about living organisms?

Students should focus on recording their observations carefully, like young scientists, by drawing pictures, writing descriptions of changes as they occur, and recording observations at various time intervals as they observe organisms throughout their life cycle. As they observe an organism throughout its life cycle, students should also include information about the organism's feeding behaviour and activity.

Attention should be paid to features of the organism's environment that enable it to meet its needs at different stages of its life cycle. Students can work together to care for these organisms.

Students should investigate constant traits, such as eye colour and number of arms and legs, and changing traits, such as height and weight. Insects, such as butterflies, moths, or meal worms, are relatively easy to study in the classroom. Many of these insects go through metamorphosis. The four stages of this cycle are egg, larva, pupa, and adult. Teachers should encourage students to use this terminology during their observations. Magnifying lenses can be used to get a closer look at the different stages in the life cycle.

The total life cycle of a meal worm is about six months. They can be kept in a large jar with holes in the top. Meal worms can be bought from pet stores as pet food.

Caution must be exercised if chicken life cycles are studied first-hand. If a resource person, such as a farmer, is willing to bring in the eggs a couple of days before they hatch, show teachers and students the proper care that must be given, and take the chicks away after they have hatched, then the activity may be undertaken. However, the eggs must be in a proper incubator, and proper care must be taken by teachers and students to ensure that the eggs and chicks are cared for appropriately.

Brine shrimp are organisms that are easy to care for in an aquarium. They are tiny and may be difficult for students to observe closely without magnifying lenses.

As students observe the life cycle of the organism they have chosen, they should be encouraged to raise questions about the life cycles of other organisms and how they may be affected by humans. Many of them may have cared for pets and will be willing to share their observations and experiences with their classmates.

Students can now explore the life cycles of other animals. If possible, these explorations should be first-hand (classroom habitats, visits to farms, zoos, aquariums, nature parks, seashore, and aquaculture farms), but in order to make comparisons between similar types of organisms (for example, between the life cycles of cod and salmon), print or electronic sources may be necessary. These resources should be well illustrated and written in simple, age-appropriate language.

Similarities and differences between the life cycles of organisms could be explored. Mammals, birds, insects, fish, reptiles (lizards and alligators), or amphibians (frogs, toads, and salamanders) can be used.

Students could compare the life cycle of the organism they have investigated to their own life cycle. Examples include animals that are born alive or hatch, animals that make cocoons or not, or animals that walk on four legs or not.

Students should explore organisms in their natural environments. They should explore how these organisms eat, drink, and move in their natural surroundings. Students could match pictures of organisms to their environments. For example, they could match frogs to ponds, birds to nests, and worms to earth. They can also explore how human-made environments (e.g., farms, zoos, aquaculture farms, aquaria) have supported the health and growth of animals. They could describe the types of environment that they would need to have if they wanted to raise different organisms, such as horses, puppies, or kittens.

Students should be able to make simple predictions about the life cycles of similar organisms and recognize patterns. For example, if they have explored the life cycle of a chicken, they should be able to predict that a robin will also have eggs that will hatch into baby birds.

Students love to see evidence that they are growing. These outcomes give students the chance to focus on their own growth over the school year. At the beginning of the school year, various measurements could be taken (hand length, foot size, distance around the head), and these measurements could be continued at intervals throughout the year.

To focus on their needs that have changed as they have grown, they could draw pictures of types of foods that they have eaten as they have grown, from milk to mashed food to solid food. Classroom displays could be set up to illustrate this progression.

Health and nutrition issues can be brought in at this point by raising probing questions. Students should be able to recognize that food is a necessary ingredient for growth.

Tasks for Instruction and/or Assessment

-Three times a week, as you watch the life cycle of your butterfly (meal worm, chick, ...), record your observations in your journal. Did you have to use any special equipment? Draw pictures to show how your butterfly is developing.

- We are going to be taking care of a _____ so that we can watch it grow. I would like to find out ... (Describe questions that inquire about what the organism will look like as it grows.)

- In brainstorming/sharing/generating questions sessions on the life cycles of organisms, assess the degree of participation and respect for others' points of view.
- Observe how: (teacher note)
  - individual students contribute to the group
  - the students describe the life cycle of the organism and how it connects to their world using applicable technology
  - they recognize that they experience changes in life too
- Build a home for the organism that you are going to investigate.
- Over the time that you have been watching your butterfly (meal worm, chick, ...) grow, what things have stayed the same? What things have changed?
- Do you think all animals go through the same stages as the animal(s) we are studying? What other animals would you be interested in finding out about? What are some questions you ask about the growth of living things?
- Present the results of your investigation of the life cycle of a butterfly (meal worm, chick, ...) to the class.
- Write a fiction or non-fiction story about the life cycle of a butterfly (meal worm, chick, ...). Include diagrams.
- Select an organism and research its life cycle using a variety of sources.
- Compare two animals. After the comparison, swap with a partner/group (or these comparisons can be modeled by the teacher) and see if you can find out the type of animal.
- Explore a natural environment that could support or hinder the health and growth of organisms.
- Construct a human-made environment that could support or hinder the health and growth of an organism.
- Prompt: Tell me some ways human-made environments have helped the health and growth of animals.
- Pretend that you have to take care of a bird (or some other type of animal) for a while. How would you take care of it? What kinds of things would you do to make sure that it is comfortable and lives as normally as possible? Draw a picture of the type of home you would make for it.
- Write about or illustrate foods that are good for me and foods that are not.
- Prompt: What is good nutrition? Why is it important to eat nutritious food?
- Create a poster of people at different ages. Select pictures that show how some characteristics change (height, weight), while others remain the same (eye and hair colour).

Learners will investigate liquids, solids, and mixtures

Background

Categorizing liquids and solids provides one way for learners to organize their understanding of everyday substances. Learners will observe the similar and unique properties of solids and liquids. They will investigate ways in which solids and liquids interact in mixtures and learn that substances can have both a solid and a liquid phase. Investigations will extend to real-world problems involving viscosity, solutions and buoyancy.

Indicators

- Investigate states of matter (COM, CT, TF)
- Investigate the properties of liquids and solids (COM, CT, TF)
- Investigate various combinations of liquids and solids (COM, CT, TF)

Concepts (and Guiding Questions)

States of matter

- How does the state of matter affect its properties?
- How can I change the state of water?

Properties of liquids and solids

- How do various liquids compare?
- How do various solids compare?

Dissolving and non dissolving

- How do various materials interact with water?
- How does mixing salt and water compare with mixing sand and water?
- How do various liquids mix together?

Skills

Investigate

Ask a question; locate several details to support an answer; organize details to compare choices; communicate findings.

Elaborations—Strategies for Learning and Teaching

This section complements and reinforces the section Forms and Changes in Moisture in the unit Air and Water. It is recommended that Liquids and Solids be done before Air and Water. A prior activity to this unit could involve a discussion of the term matter to develop an understanding that everything in the world is made up of matter.

Explorations involving water can serve as a good introduction to a wide variety of less common solids and liquids. Because water is so readily available, is inexpensive, and changes so easily from one state to another, it is used extensively throughout this unit.

The characteristics of solids can be introduced by starting with the exploration of the characteristics of water in its solid form (ice, snow, hail). By touching, shaping, letting it melt in their hands, freezing water

to make ice, making icicles, and observing frost on cold windows or glasses, students will be able to appreciate that solids have a definite shape. They will also experience ice melting into a liquid as it warms.

They can investigate ice cubes partially submerged in water and feel the water temperature before the ice melts and the temperature of the water after the ice has melted. Important characteristics that they should note are that ice has a crystalline structure (evident by viewing frost as it forms and by breaking ice cubes into smaller pieces), it is solid and therefore has a shape, and it feels cold. Heat exchanges are also important: water will turn into ice if it is cooled, and ice will turn to liquid if it is warmed.

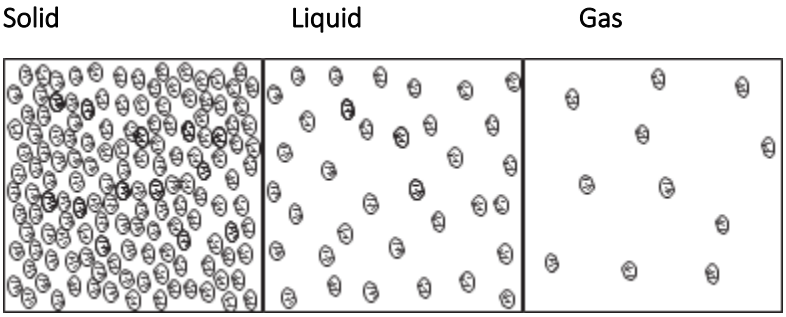
The characteristics of liquids can be introduced by exploring water in liquid form. Investigations should focus on comparisons between the properties of ice and water. Students will note that they cannot hold water, orange juice, molasses, or other liquids in their hands like they can ice cubes, and that the liquid takes on the shape of the container. Other explorations into the characteristics of water in liquid form could involve surface tension of water (floating staples or pins on water) and how water evaporates. Evaporation activities will lead to explorations involving water in the gaseous state (water vapour).

Gases can be introduced through explorations with water vapour. Students should be familiar with both evaporation and boiling. From class observations or from students' recollections of water boiling at home, they can describe the need for heat to change water into water vapour, and how it forms steam (liquid droplets suspended in air) when it cools down.

Through discussion, students could share times when they have observed water vapour: for example, when they breathe outdoors on a cold day or when they breathe on a mirror. Students could also observe frost designs on windows.

With evaporation, heat exchange is not as obvious. (Background: Evaporation occurs when water molecules break away from others at the water's surface, while boiling occurs when water particles (molecules) throughout the whole water sample have enough energy to break away into a gas.) To illustrate that heat speeds up evaporation, students can compare evaporation rates at different temperatures.

Frozen water particles (molecules) are attracted to one another and stay close together. When water particles freeze, they don't move around much. When water particles are liquid, they move around but stay fairly close together, hence they take on the shape of the container. When water particles get hot, they move faster and farther apart. Some of the particles or molecules escape into the air as gas.



Students should be able to predict what will happen to the various forms of water when they are heated or cooled. Water is the only substance that can be found in all three forms—liquid, solid, and gas— in nature. This will lead into a discussion of the water cycle. Students could be asked to explain how they

think rain is formed and to describe the three forms of water in nature. Students should be introduced to the terms **condensation, evaporation,** and **precipitation.**

Opportunities to observe condensation of water vapour on cold surfaces will further reinforce the notion that water can change from one form to another. Students should be able to predict what will happen to the various forms of water when they are heated up or cooled down.

Students can act out the movement of particles. Teachers can mark off an area, like a square. Students can stand in the area and follow instructions to move like the particles do when they are solid, liquid, or gas.

In classroom discussion, students and teachers can discuss their findings about the water, ice, and water vapour. Teachers can monitor students' discussion to extend their ideas to other solids and liquids. Do they think all liquids and solids have the same properties? In what ways might they be different? How can we find out? Encourage students to make "I wonder ..." statements that could be used as a starting point for exploration, such as "I wonder if all liquids are as runny as water" or "I wonder if there are other solids besides ice that melt in your hand." As they explore the properties of common liquids and solids, they will probably have more "I wonder ..." statements.

Students can explore the properties of various solids such as chalk, salt, sugar, wood, and metals by noting their properties such as appearance, hardness, texture, colour, odour, and ability to be broken into smaller pieces or shapes.

Throughout these explorations, students should become used to wearing safety goggles. A number of common, safe liquids (see Science Safety Guidelines) such as juice, water, milk, soft drinks, and molasses can be used in these explorations. Students can explore the properties of these liquids by noting colour and odour and by rubbing their hands with each of these liquids. They can explore the thickness (viscosity) of the liquids by stirring the liquids with a spoon or seeing how easily the liquids swirl or pour.

Some properties of materials are determined by how they interact with other substances. Students can observe what happens when drops of liquids are placed on wax paper, tin foil, cardboard, cotton, or other type of surface. They can note things like the shape of the drop on these surfaces and if the liquid wets the surface. Students can have a liquid drop race and select which liquid they want to race and material they want to race it on.

Charts and drawings should be used to record their observations in the following activities. For example, a chart of what floats in water and what does not could be filled in by the students. Drawings could also illustrate the same thing by showing some objects floating, while others have sunk to the bottom.

Students can explore in learning centres how some solids float on water (pepper), dissolve in water (salt, sugar, drink crystals), sink in water (sand), or form suspensions in water (cornstarch). An interesting mixture is formed from cornstarch and water. If students scoop the mixture into their hands, it can behave as a solid or a liquid depending on the pressure they exert on it. If they hold it tight in their fist, it will behave as a solid, but if they loosen their grip, it will seep through their fingers like a liquid.

Students can experiment with various objects, such as paper clips, crayons, pieces of wooden stir sticks, jelly beans, to see if they sink or float in water.

Students can use fresh water and salted water to experiment with making sinking objects float and floating objects sink. For example, place an egg in fresh water to observe the sinking. Then add progressively larger amounts of salt and observe the outcome.

Use everyday examples to introduce the idea of whether the type of liquid an object is in will let it float or sink. Do liquids always mix? Students can also investigate what happens when different liquids are mixed, for example, cooking oil and water, or dishwashing liquid and water, to see which ones float and which ones mix. Finally, students can make a mixture of cooking oil and water, and then add the solid objects again. Some objects will float on top, some will float on the bottom layer, and some will sink all the way to the bottom.

Using their knowledge of sinking and floating, students can generate a number of challenges that will involve designing solutions. Some examples are designing a boat or raft from materials such as wax paper, aluminum foil, or modelling clay that will carry the most pennies; making a floating object sink; making a sinking object float, or making a sinking object stay suspended halfway.

Students can work together in co-operative groups to solve problems, share ideas, and test solutions. After they have finished refining their product, be it a raft, boat, attachments for sinking objects or for keeping them afloat, they can share their observations by demonstration or in an oral presentation to class. Connections to technological products can be made by illustrating, for example, how lobster pots (made of wood) are sunk, how heavy metallic boats can float, or how fishers use a variety of floaters and weights to have their nets and lines sink or float to appropriate levels.

Up to this point, the interactions between liquids and solids have, for the most part, left the original liquid or solid intact. In this part of the unit, new products and materials are formed from these interactions.

Cooking and making construction materials, such as mud bricks, gelatine, or playdough, are good contexts for this section. There are a wide variety of activities that can illustrate these outcomes; selection of which ones to do depends on availability of materials and tools such as staff room ovens or refrigerators. If these are not available, there are still many products that can be made. The focus in this section should be twofold: the products made should be useful and seen as fitting a human need, and the characteristics of the product made should be different than the components used to make it.

Students can make playdough using flour, salt, and water. They can add different colours of food colouring to the dough to get multi colored dough. They can experiment with varying the amount of water in order to change the texture of the dough.

Students can prepare a package of gelatin according to directions. Encourage students to observe the characteristics of the ingredients before and after preparation. This will note the change that can happen to substances, which is always a good observation to make.

Plaster of Paris can also be used to make useful objects. Alternatively, students can mix flour and water to make a paste to be used for papier mâché.

Simple chemical reactions can be done to illustrate new materials being formed. Students may wish to help make cookie dough and compare the dough to the baked cookie. Students can drop baking soda into vinegar to yield a burst of bubbles. Yogurt and baking soda will also give a bubbling mixture. The reaction of the yeast on bread dough may be observed in a bread machine.

Students could also investigate the ability of certain materials to soak up oil. This would simulate the real-life situation of cleaning up after an oil spill. Students could note the ability of sawdust, kitty litter, feathers, human hair, moss, and other materials for soaking up oil.

Tasks for Instruction and/or Assessment

- Have students go on a matter hunt. Sort and categorize the matter they have found according to a variety of characteristics (type of material, shape, function, size, colour, solid, liquid, etc.).
- Given an ice cube (or freezy) a student is to melt this ice cube (or freezy) as quickly as possible (without opening the freezy). (You are not allowed to put it in your mouth.) When you are finished, tell your classmates the strategies that you used to melt your cube. Make a class list of ways to melt ice.
- Take two paper cups and put equal amounts of water in them. Put one in the freezer until next day. Put the ice from one cup in a bowl and put the water from the other cup in a second bowl. Which form of water can be poured? Which one covers the bottom of the bowl? Which one can you pick up? Which one changes shape when you put it in the bowl? Which one feels cold?
- What will happen to ice if I hold it in my hand? What will happen to water in a glass if it is left to sit for a long time in the sun?
- Put an ice cube in a cup of warm water and observe what happens. With a partner, talk about what you think is happening. When you have finished, feel the temperature of the water. Draw before and after pictures and label them to describe your observations. This can be done in an ongoing science journal.
- Prediction: A student puts equal amounts of water in two glasses with the same size and shape. One glass was put by a heater and one was put in the refrigerator. Draw what you think the glasses will look like after a period of several days. Explain your drawing.
- Put a couple of drops of warm water on your hand. Wave your hands gently. What do you feel? Do you feel the same way when you step out of a warm bath or shower, or a swimming pool or lake? What happens to the water on your hand?
- Pass out small mirrors to students (or use the classroom window if it is cold). Breathe on the mirror several times. Rub the mirror and describe what you see and feel. (The water vapour condenses on the cooler mirror.)
- Act the part of each type of water
  - solid: students stand close together, move very slowly but stay together
  - liquid: students stand further apart, then move around each other
  - gas: students stand far apart, move, and jump around quickly
- Draw a picture to show the water cycle.
- Perform a play about the water cycle.
- Explore the properties of a variety of solids and record their observations in their science journals. Does the solid bend? Does it float? Can you scratch it with a nail? Will it roll?
- Which piece of material will soak up water the most? Put a drop of water on each piece of material (e.g., wax paper, cardboard, white paper, construction paper) and tip the material. Record how far each drop travelled before it soaked into the material.
- What are some things you know about liquids? Do you think all liquids are alike? What are some things that we could test to see if liquids are alike or different?

- What floats? Take each of the objects and see if it floats in water. Draw pictures of the objects showing what they do when they are placed in a bowl of water.
- Do all liquids mix? Draw pictures to show how the liquids mix. If layers form, label each layerIn a clear cup, pour equal amounts of water and vegetable oil. Add some food colouring. Which layer does the colouring mix with? Draw a picture to show your observations.
- In a tall glass or bowl, add equal amounts of water and vegetable oil. Carefully drop different objects in the bowl. Record your results. (Give each student a 10 cm × 10 cm piece of aluminum foil so that each student has the same amount of foil.) With a partner, design a floating device that will hold coins. Demonstrate your floating device to the rest of the class.
- With a partner, add a couple of drops of vinegar to a spoonful of baking soda in a glass. Keep adding drops of vinegar. What new type of substance did you form?
- Add a few drops of water to some cornstarch and mix until it looks a bit like glue. Do you think it is a solid or liquid? What evidence do you have to support your answer? Now try to hold the mixture in your hands loosely. What happens? Do you think it is a solid or liquid? Now hold onto the mixture again, and grip it tightly and quickly. What happens? Is it acting more like a solid or a liquid?
- Recycling can help us keep a clean environment. Things I recycle at home are ...

Learners will test motion of objects

Background

The study of moving things offers learners an opportunity to develop a sense of space, orientation, perspective, and relationship. Through observation, and the use of specific language, learners develop the ability to describe where things are and how they are moving. Learners will explore how descriptions of an object's position and motion depend upon their perspective. Various types of motion will be explored as well as the factors that affect motion. Learners will engage in problem solving as they design and construct their own devices that move in specific ways. Learners will explore the design of fair tests which is the foundation for further scientific investigations involving control of variables.

Indicators

- Investigate types of motion (COM, CT, TF)
- Investigate factors that affect motion (COM, CT, TF)
- Investigate relative position and impact of perspective and orientation (CZ, COM, CT, PCD)
- Test ramp properties for their impact on motion (COM, CI, CT, TF)

Concepts (and Guiding Questions)

Types of motion

- How can I predict how an object will move by examining it?
- How can I draw a diagram of the motion of an object?

Factors that affect motion

- How can I design a fair test to determine which toy car will move the fastest? Farthest? Slowest?
- How can I build an object that moves?
- How can I change how an object moves?
- How do height and surface properties of a ramp affect the motion of an object?

Relative position

- How can I identify an object's location using another students' description?
- How can position be described?

Impact of perspective and orientation

- How are perspective and orientation related?
- How does the appearance of an object change based on the perspective it is viewed from?

Skills

Test

- Formulate a testable question; Hypothesize a reasonable result; Identify possible variables and intentionally control variables; Design and conduct a simple experiment; Collect and record evidence using the senses; Draw conclusions based on evidence; Communicate findings; Predict the results of a similar experiment and justify the prediction; Evaluate limitations and improvements

Investigate

Ask a question; locate several details to support an answer; organize details to compare choices; communicate findings.

Elaborations—Strategies for Learning and Teaching

Students can observe the various types of motion and be challenged to start thinking about the way things move and what they might make to show one or more types of movement. Over the course of the unit, they should be given the opportunity to design and construct their own devices such as matchbox cars, sail boats, or paper airplanes. Various methods of propulsion can be used such as balloons, magnets, sails, or propellers.

Facilitate an active introduction to the unit by assembling a collection of models of machines, each using a specific motion: rolling, swinging, rotating, sliding, etc. The machines can be used to introduce the terminology to be used throughout this unit. K'Nex Educational Kits, Lego Early Simple Machines with activity cards, or Cube-A-Links would also serve this unit well.

As students observe and interact with various moving objects, they can learn descriptive phrases that can be used to describe the position of objects, use language such as "to the left of," "on top," "beside," or "two giant steps behind." Students can become their own balance. Identify different positions for the students to make and have the students describe their position and how they may or may not be balanced.

Students can make "Balancing Bob or Betty" from a wine cork with a nail inserted in the middle, a pipe cleaner, and modelling clay. Students can balance this on a water bottle with the cap on. This balancing should be done without students seeing the prototype so that the students can explore their own creation. Students can decorate their cork with googly eyes and so on.

The teacher can construct a model using kit materials such as those found in Lego or materials on hand. This model is then hidden from view by placing it in a large box turned on its side (labelled "Top Secret"). One student from each group is assigned the job of Spy and is the only member of the team allowed to leave his/her seat and view the hidden model. The student must explain to the rest of the team how to duplicate the model (using a similar kit). Pointing at parts is not allowed. This activity forces the development of terminology for the students.

Working in groups of two or three, students can place an object such as a paper towel tube in a certain position and then move to different parts of the room to view it. They can then describe how the relative position of the object changes. Using a construction kit, the students can build models and then describe the relative positions of the components from different perspectives. These activities reinforce the development of spatial sense.

Alternatively, students can work together to create a map for a "buried treasure," using a variety of reference points and measures. If done orally, students can be challenged to describe more that one way to get from start to treasure. Connections can be made to the social studies curriculum, where they learn to use terms such as **north, south, east,** and **west.**

Teachers can make a motion list of words that describe various positions and motions that occur in the unit.

Students can explore the motion of a variety of objects that exhibit different types of motion such as spinning, swinging, bouncing, rolling, sliding, vibrating, or moving in a straight line (for example, tops, spring-operated toys, rubber balls, toy helicopters, Venetian blinds, and pendulum clocks or playground motion such as swinging, sliding, or going on the merry-go-round). This may give them ideas for their own devices that they will construct.

Students should use appropriate language such as backward, forward, and sideways to describe the motion of these objects. Their descriptions should focus not only on the types of motion exhibited, such as rolling and vibrating, but also on the object's motion relative to other objects in the room.

Once again, individual students' perspectives play a large role in describing the motion. Activities relating to different perspectives should be kept simple. This will reinforce math outcomes from grade 1 and 2 related to slides and flips.

Prepare a set of cards with each card labelled with a motion word, e.g., rotating, bouncing, swinging. Working in teams, students can draw motion cards and construct an object that illustrates their motion using building materials.

One student can pull another in a wagon or in the gym on scooterboards, with other students circling the room. The student in the wagon can describe the motion of the other (stationary) students from his/her perspective. For example, "Tommy is moving towards me; Jane is moving away from me; Patrick is moving to the left."

This should generate a lot of discussion, since the other students will argue that they are not moving. From the perspective of the student in the wagon, they are. The other students in the classroom can describe the motion of the student in the wagon from their own perspectives.

Students can demonstrate their experiences in a moving car—how trees and houses appear to move past them and how the car appears to be stationary. Alternatively, they can describe the motion of other objects when they are swinging or on other playground equipment.

As students explore the motion of various objects, they can be encouraged to find ways to change the motion of an object and identify the factors that affect the motion. The possible factors that they investigate could include the amount of force (introduce this concept here and define it as a push or a pull), the mass of an object (how heavy it is), the height of the ramps they will use to roll things down, and the type of surface that an object is moving over (e.g., carpet, smooth floor). The focus of these activities should be, as much as possible, the development of fair tests.

Students investigate a variety of motions to try to determine factors that affect them (such as height of a ramp, surface of a ramp, and the type of object being rolled down the ramp). For example, students could investigate how to keep an object spinning for longer periods of time or compare/contrast two objects' ability to spin. They could roll various objects down ramps and time the descent to see which ones roll faster or measure the path with a string or measuring tape to see which ones roll furthest. They can try to determine if empty containers roll faster than full ones or if containers filled with liquids roll faster than those filled with solids. They can investigate the effect of rolling cars with different wheel sizes down the ramp. They can investigate how various surfaces or the ramp angle affect an object's ability to slide. They could investigate how the length of a Slinky or spring or the suspension of a weight affects its up-and-down motion. The could make gels of various thickness (not lubricants) to see how these affect its ability

to vibrate or jiggle. They can test the viscosity of liquid foods by racing them down a ramp covered with waxed paper.

This list simply illustrates the variety of motions that can be investigated; there are many more investigations that the students could explore beyond these.

The students could be challenged to make an object that moves in a specific way. Students should be given opportunities to construct this device and use what they have learned in this unit. It can then be tested on the basis of the motion that they have designed it for and compared to their classmates' devices.

Tasks for Instruction and/or Assessment

- Create machines that meet certain requirements or invent a new machine and explain its function.
- Design and make an object that balances.
- Create a model, given verbal or written instructions. A simple example utilizing geometric solids follows:
  - Place a cube on your desk.
  - Place one sphere behind the cube.
  - Place a rectangular prism on top of your cube.
- In a group of four, create a machine to demonstrate a specific motion. Classify the movement of each machine. Then challenge teams to build a machine that demonstrates a variety of movements.
- Create a model given verbal instructions. Describe the position of various components of the model from different perspectives.
- Find an object from another student's description.
- Using geometric shapes such as a cone, cube, or sphere, investigate how these can be moved across the desk (Which will slide? roll? do both?).
- On the playground, explore something that makes you
  - move up and down
  - move downward and forward
  - move in a circle
- Create a grid on the classroom floor using masking tape and play a game of human checkers using instructions such as "move two spaces to the right" or "move two spaces forward." Have some students stand in various squares. Give directions for the students, as a group or individually, to follow such as "move one step backwards," "move two steps to your right," "turn north," "move one step south." (Teachers should note that the level of difficulty can vary depending on the student's ability, from forward/backward to left/right to a direction.)
- Examine the motion of a variety of wind-up toys. Predict and create a map of the pattern of movement each displays. Label the map.
- Choose some objects in the classroom and describe how they move, e.g., pencil sharpeners, doors, or windows.
- Predict which toy truck (ball, soup can) will reach the end of the ramp first. Design a fair test.
- Test the effects of different ramps on the motion of an object (toy car or truck).
- Rough surface may be sandpaper, rug, or fabric. (Materials needed are ramps, blocks, suitable construction materials, chart, pencil, measuring tape.)

- Using similar-size soup cans containing different materials, predict and test which one rolls further.
- Your task is to try to make your ball roll down this ramp as fast as possible. In your journal, write down the things you would like to try, to see if you can make it speed up.
- Design and make your own toy or gadget that moves. Try to make
  - an object that goes to the left
  - a paper glider that spins in the air
  - the downhill racer that rolls the furthest

Appendix A
Activities for Earth and Space Science: Air and Water in the Environment

Activity 1: Where Is the Air?

Assessment

Observe student participation in activities, including the ability to follow directions and use appropriate materials to build an instrument. Do students use drawings, writing, and language to perform and record their observations?
Tasks may include the following:

- constructing a wind speed indicator and using it to measure the direction and speed of the wind
- science journal entries (assess written expression and labelling of diagrams)
- paper and pencil tasks, drawing to show how they know air takes up space or that air can move things
- interviews, responses to questions

Questions

Where is air?
What is air?
Is air all around us?
How do you know it's there?
How can you show me that the air is a real substance when you can't see it?
Does air take up space?
Can air move things?
How can I know that it's really windy out?
How can I know which way the wind is blowing?

Materials

Sandwich bags
Science journals

Procedure

1. Record the information students give on chart paper. The list may be added to as the exploration continues.
2. After discussions show the children a sandwich bag and ask if it is possible to fill the bag with air? How would that prove that air is a substance and takes up space?
3. Have each student fill a sandwich bag with air. Allow the emptying and refilling of the bags as the students experiment with various methods of filling. Be aware that there will be bags that will pop.
4. Redirect students back to discussion asking, What evidence do you have that air has gone into your bag?
5. Have them record their responses in their science journals using a before-and-after format.

Activity 2: Direction of the Wind

Assessment

Observe student participation in activities:

- student's ability to follow directions
- student's ability to build an instrument
- student's ability to record information

Questions

What differences did you notice with your "wind director" indoors compared to outside?
How were you able to tell the direction of the wind using your "wind director"?

Materials

Pencils with erasers
Thumbtacks
Assortment of streamers and ribbons
Science journals

Procedure

1. Discuss with students that, besides the speed of wind, it is sometimes important to know the direction that the wind is blowing. Can they give you examples? Record their responses on chart paper. Sailors, kite flyers ...
2. Show the students a previously made "wind director." Ask their opinion or predictions as to how they think this device will show them which way the wind is blowing. Students can record their responses in their science journals.
3. The students will each build a wind director. They will then go outside to determine the direction of the wind.
4. Have students plan certain locations to try out their wind directors. Have them record their locations and results in their science journals.
5. Discuss and compare the results of their tests once they have finished recording their observations.
6. Prompt with questions, "Were there places your streamers did not move? Did the direction of the wind change when you stood in different places? How do you know? If you were outside and wanted to be protected from the wind, where would you go?"

Activity 3: Moisture in the Environment

Assessment

Students are able to

- find evidence of moisture in the environment
- record and interpret their observations

Questions

What is moisture?
Where can we find it?
Can water/moisture take another form?
Where does the dew come from that is on everything during spring and summer mornings?
Where does the dew go?
Where do the rain puddles go?
Is there moisture in apples? oranges?

Materials

Magnifying glasses
Journals

Procedure

Students should identify places where they find moisture or water.
Students can use tools such as magnifying glasses, beakers, and rulers to help in their observations. Students should record their observations.

Activity 4: Where Has All the Water Gone?

Assessment

Students are able to build a mini-greenhouse.
Students are able to record and discuss changes they observed in their greenhouse.

Questions

Did you notice any drops on the bottle sides, any misting or clouding inside the bottle?
Were there any drops dripping down the sides of the bottle?
What about the plastic wrap on the top, are they any drops on it? How did they get there?

Materials

Empty 2-L pop bottle with cap
Soil
A small plant
Small stones, pebbles
Small sticks
Water
Plastic wrap
Elastics
A sunny location in the classroom
Science journal

Procedure

1. Discuss where water goes after it rains or snows. Draw examples from the previous activities. Where did the water go that was on the plates? Record the students' ideas.
2. Students will be constructing a small greenhouse. Tell students that they will be making a small environment that has moisture, but that they are going to seal off any escape paths for the moisture to leave.
3. Have the pop bottles cut in half by an adult.
4. Students fill the lower half with soil, small plants, and a few pebbles and sticks. The bottle cap is filled with water and placed in the environment. This becomes the pond. A good soaking of the soil is needed before the top half of the pop bottle is squeezed over the bottom half.
5. To ensure a snug fit, a vertical cut can be made at the top of the bottom part so it may overlap.
6. Place a piece of plastic wrap over the opening and secure it with an elastic band. Place the finished mini-greenhouse in the sunlight.
7. Students draw their greenhouses from a side perspective and bird's- eye view. Try to get them to be as accurate as possible.
8. Record any changes that the students observe over the next few days.

Activity 5: Weathering

Assessment	Students are able to detect the effects of weather on structures.
Questions	What changes can we see in our structures over time? What happens to human-made structures if they are not taken care of properly?
Materials	A new board A weathered board
Procedure	Discuss with students the effects that weather has on structures. If possible, go for a walk around the school and area to look for signs of weathering. When they return to class, make a list of what they observed. Students have a record of signs of weathering. Thus, an awareness will evolve of the effect of natural weathering on our structures and a knowledge that we have to protect them.
Extension	Students should collect pictorial images of weathering for a weather picture. Students should collect a list of products available from local hardware stores designed to reduce the impact of weathering.

Activity 6: Protecting Our Water Sources

Assessment

Observe student participation in activities and discussions. Does the student use drawings, writing, and language to communicate and record his or her observations and ideas? Tasks may include the following:

- using science journal entries, to describe how we use water; recording data and creating a pictograph
- recording and presenting reasons for our water to be clean

Questions

Where does water come from?
Where can we find water?
How do we use water?
Is water important to us?
Do we need water?
How does water get into our houses, our school?
How do people get clean water?
Does everyone get it the same way?
Is it important that water be clean and not polluted?
Does everyone in the world have clean water supplies?

Materials

Science journals
Poster board
Old magazines for cutting and pasting
Colouring supplies

Procedure

At the start of this activity, have students record the ways they use water. Share ideas and thoughts on ways to keep our water system clean and the importance of having clean water around the world.
In small groups, have students create posters that highlights the importance of clean water. Suggest ways to conserve water and action we need to take to keep our water system healthy.

Activity 7: Where Does Our Clean Water Come From?

Assessment

Students are able to make a water filter.
Students are able to explain the importance of clean water and the use of water filters.

Questions

Where is water in my life?
What materials may be in pond water? ocean water? wells? lakes?
Do the materials/substances in water help it? Give reasons to support your answers.

Materials

Muddy water
3 clear plastic 2-l pop bottles, cut in half/per group
Coffee filters, 6 per group
Cotton balls
Sand
Gravel
Soil
Measuring cup and water
Science journal

Procedure

Students can identify sources of water in their local areas, such as streams, lakes, ponds, oceans, or wells. They can explore where their drinking water comes from through field trips and/or guest speakers. They can learn how it is treated to make it clean and safe to drink.

1. Before the water is pumped into people's homes, dirt and germs have to be removed. How is water from lakes and rivers cleaned?
2. Show students the muddy water. Tell them that as city planners, their job is to think of a way to clean the water.
3. Instruct the students as to how to make a basic filter holder. They will need the two parts of their clear pop bottle. Turn the top upside down and put it inside the bottom half of the bottle.
4. Show the students the materials that they may use to test their water filters (cotton balls, sand, gravel, soil, marbles).
5. The students must select three different materials to test in their filters. Have them record the materials they have decided to test.
6. Have the students plan a fair test to find out which of their chosen material cleans the dirty water the best. Guide students toward the importance of proper measurements. Each filter to be fairly tested must have the same amount of muddy water poured into it. Have the students record their predictions before they begin and then their results after their tests are completed.
7. Can the students determine if there is one material that will make the water cleaner than the others?

Appendix B
Activities for Life Science: Animal Growth and Changes

Activity 8: Hatching Chicks

Assessment

Students are able to describe the changes in the development of the embryo of a baby chick.
Students are able to identify the human-made environment a baby chick needs once it has hatched.

Questions

What did you observe about the growth of a chicken?
How did the baby chick get out of its shell?
What did the baby chick need in order to survive?
How many days did it take for the chickens to hatch?
Did the mass of the eggs change over the cycle of development of the chick?

Materials

Commercially purchased incubator
Fertilized chicken eggs
Food for the baby chicks
Brooder or a container to keep the baby chicks warm once they are removed from the incubator
Rubber gloves
Pictures or illustrations of the 21-day growth cycle from embryo to baby chick

Procedure

This is a very exciting learning experience for students. However, prior to considering this learning experience teachers should be able to answer the following questions.

- At what temperature does the incubator need to be maintained?
- How are the eggs rotated?
- What do I do if none of the eggs produce chicks?
- What do I do if a chick starts to hatch (crack open the shell of the egg) and after 24–48 hours has still not hatched and the membrane inside the shell has become hard and dry?
- What do I do if a chick hatches and is either deformed or has a broken leg?
- What do I tell the students if a baby chick dies?
- How do I make a brooder and at what temperature do I keep it?
- What precautions do I need to take with children handling the baby chicks and salmonella germs?
- How do I handle the eggs in order that children can observe the growth of the embryo?
- Is there a local veterinarian or farmer that could help me out?
- Where will I take the chicks after this observation period?

If you feel confident in carrying out this activity, follow the procedures as set out by the company from which you purchase the incubator. “Candle” the eggs for the students prior to putting them in the incubator. Then “candle” them or a few of them every four days. Have students keep a record of what they have observed in their science logs.

Activity 9: The Life Cycle of a Butterfly

Assessment

Students are able to record through illustration and written expression the life cycle of a butterfly.
Students are able to identify the stages of the life cycle of a butterfly. Students are able to develop an appreciation for the life of an organism.

Questions

What are the stages of the life cycle of a butterfly?
How do their form, shape, and size change during each stage?
What does each stage need for food in order to survive?

Materials

Pictures of the stages of the life cycle of a butterfly
Butterfly larvae kit
Butterfly pavilion

Procedure

If you are purchasing a commercially developed kit, you should plan on doing this activity in the spring. Kits come with complete directions to have this activity meet with success. Discuss the four stages of a butterfly with the students (egg, larva, pupa, and butterfly). Take the students outdoors to see if they are able to observe any stages of the life cycle in the environment around the school. Have the students record their observations. Discuss the importance of respecting the life cycle of organisms. When it is time, go outside with the students to release the butterflies.

Activity 10: The Mealworm—An Information Sheet for Teachers

- Mealworms are actually the larval stage of the darkling beetle. The mealworm or larva stage is worm-like in appearance, hence the name mealworm.
- Mealworms average in length of about 2.5 cm.
- Their outer shell or exoskeleton is yellowish brown in colour and cylindrical in shape.
- The adult beetle produces eggs, which hatch into mealworms in approximately two weeks.
- The mealworm stays in the larval stage for approximately 10 weeks.
- During this time period it will shed its exoskeleton from 9 to 20 times.
- The mealworm turns into the pupa stage after the 10-week period.
- Within two to three weeks the pupa will split open, and an adult beetle will emerge.
- Adult beetles mate and lay eggs, and the cycle will start again.
- Mealworms should not be kept in direct sunlight, near air vents, or in cold drafts.
- Mealworms prefer dark warm places.

Activity 11: Growing Mealworms—Getting Started

Assessment

Students are able to set up an environment in which mealworms can survive.
Students are able to explain the needs of a mealworm to survive.
Students are able to illustrate and describe what their mealworm looks like.

Questions

What type of an environment do mealworms need to survive?
What are the needs of a mealworm?

Materials

Plastic containers with covers (air holes)
Bran flakes, oatmeal, whole wheat flour, or cornmeal
Slices of apple (for moisture)
Mealworms (purchased from a pet shop)
Plastic spoons

Procedure

Have a plastic container for each student. Label the containers with the students' names. Have students put oatmeal and an apple slice in their container (apple slice should be replaced when it dries out or becomes mouldy). Place a few mealworms in each container using a plastic spoon. Have students observe what their mealworms do. Have them record their observations. Explain to students that their mealworm is in the larva stage.

Activity 12: Growth and the Environment

Assessment

Students are able to observe various organisms in their environment.
Students are able to explain how an organism's environment supports its health and growth.
Students are able to explain how human-made environments support an organism's growth.

Questions

How does the environment that an organism lives in support its health and growth?
How have human-made environments supported the health and growth of organisms?

Materials

Attribute hoops
Hand-held magnifiers

Procedure

Take students outdoors and have them section off an area with their attribute hoops. Have students observe and record the types of organisms they find. Have them record the type of environment that the organisms are found in (e.g., grass, soil). Have students discuss how the environments they found their organisms in support their growth.
Students could be taken to a lake or pond to observe living organisms there. Students could be taken on a nature walk to observe how human- made and natural environments support the growth of organisms (birds' nests in trees and in buildings).

Appendix C
Activities for Physical Science: Liquids and Solids

Activity 13: Ice Melt Race

Assessment

Students should be able to communicate to classmates strategies used to melt ice. A class list of ways to melt ice can be composed. Students can draw pictures of how they melted their ice cubes in their science journals.

Questions

What is the quickest way to melt an ice cube? (You are not to put the ice cube in your mouth.)

Safety

Ice cubes should be put into a tied baggie to avoid discomfort to hands.

Materials

Timer or clock with second hand
Ice cubes in baggie
Chart paper (class list)
Student paper or journal

Procedure

1. Students can examine the ice cube and discuss words to describe it.
2. Students predict what will happen to the ice if left out of the freezer.
3. Students are then to melt the ice cube as quickly as possible. A time limit could be assigned and a clock with a second hand used to time.
4. Record ways to melt ice.
5. Draw a picture and explain how you melted your ice cube.

Activity 14: Liquid to Solid

Assessment Students should be able to predict and describe changes in water when it is frozen and draw and explain changes.

Questions How does water change when it is placed in a freezer?

Materials
2 clear plastic glasses
Marker
2 bowls
Thermometers
Access to freezer

Procedure

Part 1:

1. This activity spans a two-day period. On the first day, put equal amounts of water in the two plastic glasses. (This can be a teacher demonstration or a group activity, depending on amount of freezer space.) Mark levels on both glasses with a permanent marker.
2. Put one glass, marked "B" in the freezer until the next day. Remove from freezer. Compare level on each glass; mark again. Record observations

Part 2:

1. Now, put ice in one bowl and water in a second bowl. Students should answer the following while exploring: Which form of water can be poured? Which one covers the bottom of the bowl? Which one you can pick up with your hands? Which one changes shape? Have students record their results.
2. After the ice has melted, use a thermometer to compare temperatures. Class charts could be started. Properties of solids and properties of liquids could be added to throughout the unit.

Activity 15: Evaporation—Disappearing Water

Assessment

Students are able to predict what will happen to water left in a glass.
Students are able to record findings on a record sheet.

Questions

What happened to the water?

Safety

Keep students a safe distance from the boiling water.

Materials

Plastic glasses, one per group
Markers
Measuring cup

Procedure

1. Members of each group pour a measured amount of water into a plastic glass. Water level is marked with a permanent marker. Glasses are placed on a window ledge (preferably with access to sun or heat source).
2. Students check water level after three days. Record. Pour contents into measuring cup to compare level on first and third day.

Extension

While we see the results of evaporation when we set water in a warm place, we do not actually see it happen. You may wish to boil water so students can see water evaporate before their eyes.
Discuss with students how they saw water change from ice to liquid to water vapour or gas.

Activity 16: Condensation

Assessment

Students are able to understand where the water comes from.
Students are able to record findings on a record sheet.

Questions

Where does the water come from?

Materials

Two plastic glasses per group
Ice
Access to freezer

Procedure

1. Students place glasses side by side. Fill one glass with ice.
2. Observe and predict what will happen. Share questions and predictions. What happened to the glass with the ice? What happened to the glass with no ice? Where did the water on the outside of the glass come from? Why didn't the empty glass get wet?
3. Record observations.

Activity 17: Investigating Solids

Assessment

Students are able to predict, investigate, and describe properties of solids.
Students are able to record information on solids.

Questions

What are some properties of solids?
How would you describe a solid?

Safety

Instruct students not to taste or put anything in their mouths.
Check for allergies.

Materials

Wood
Wax candle
Metal spoon
Nail
Pencil
Sugar
Rice
Modelling clay
Rock
Resealable bag

Procedure

1. Pass out bag of solids (one bag per group of 4–6 students).
2. Ask students to test solids. Generate questions such as, Can your solid bend? What does it feel like? Can it be broken into smaller pieces? What does it smell like? Can you scratch it with your nail or pencil?
3. Have students make observations and draw conclusions of the properties of solids.

Activity 18: Investigating Liquids

Assessment

Students could communicate their observations. They could also share their discoveries in a whole-class discussion at the end of the lesson.

Questions

What are some of the properties of a liquid?
How are liquids different from solids?

Materials

Clear plastic cups
Water
Two other liquids to test (e.g., oil, dish detergent, fruit juice, molasses, black tea, liquid tempera paint, honey, etc.)
Meat trays
Eye droppers
Wooden stir sticks

Procedure

1. Begin the lesson by asking some questions about liquids.
   - What are some things you know about liquids?
   - Do you think all liquids are alike?
   - What are some things we could test to see if liquids are alike or different?
2. Chart the students' responses. Explain to the students that they are going to be doing some experiments today to try to discover the identity of three mystery liquids.
3. Demonstrate how to perform comparison tests. Compare smell, see-throughness/opacity, touch/feel, runniness/viscosity, colour. There may be more comparisons specific to the liquids that are used.
4. Show students the proper way to smell a liquid, by waving their hand over the item they want to smell.
5. Show the students how to test the runniness of a liquid by putting a drop of each liquid on a meat tray then tipping the tray and observing which one moves the fastest/furthest.
6. Show the students how to test the thickness of a liquid by stirring the liquid with a stir stick or spoon and seeing how easily/quickly it stirs.
7. Once you have reviewed how to compare liquids, organize the students into small groups (three to four students) and hand them the three liquids to be investigated in clear plastic cups marked, A (water), B (test liquid #2—choose from oil, dish detergent, and liquid soap), and C (test liquid #3—choose from fruit juice, black tea, molasses, honey, and paint). Also give each student any equipment needed to perform the tests (meat tray, stir sticks, eye dropper). Challenge the students to perform the comparison tests and try to identify each liquid. As a class, discuss findings.

Activity 19: Water Race

Assessment

Students are able to predict and test which material will absorb liquid best.
Students are able to record observations.

Questions

Which material will soak up the most water?
What are some of the differences between the materials?

Materials

Water
Eye dropper
Wax paper
Cardboard
White paper
Construction paper
Metric ruler

Procedure

1. Select several materials of equal length. Place a drop of water on each of the materials 2 cm from one end. Watch how the water travels by itself down the materials.
2. Record how far each drop travelled before it was absorbed by the materials.

Activity 20: Liquid Race

Assessment Students are able to test liquids and fill in record sheet.

Questions Which liquid flows most easily?

Materials
Petrie dishes or similar containers
Shiny poster board
Mustard
Ketchup
Molasses
Vinegar
Dish detergent
Spoon
Paper towel

Procedure
1. Look at several Petrie dishes (or any other same size containers), one for each of the liquids you are going to use. Each dish contains an equal amount of liquid. For example, dish #1 may be water, dish #2 may be vinegar, and so on. Then place an equal amount of poster board on top of each of the liquids. A 5 cm x 5 cm sample is suggested.
2. Observe if the paper floats on the liquid. Observe if any of the liquid is absorbed into the poster board.

Extension An extension of this activity would be to see whether temperature affects absorption and viscosity. Cool some ketchup by placing it in the refrigerator. Heat some ketchup by placing it in the sun or a warm area. Test.

Activity 21: Mixing Liquids

Assessment

Students are able to record their observations.
Students are able to observe differences in liquids when they are mixed.

Questions

Do all liquids mix?
What changes did you observe when the liquids were mixed?

Safety

Remind students not to taste their new mixtures.

Materials

Jars (baby food type are good)
Water
Milk
Oil
Vinegar
Syrup
Fruit juice
Italian dressing

Procedure

1. Organize the students into small groups.
2. Provide each group with five jars with lids, the liquids to be explored.
3. Explain to the students that they are to draw a picture of what the liquids in the jar look like after they are mixed together. Remind them to show the colour and to label any layers that may form.
4. After all the students have had an opportunity to test all the liquids and record their findings, have them discuss, as a class, what they have observed and discovered.

Extension

The students could choose other liquids they would like to test to see if they will mix.

Activity 22: Exploring Solids in Liquids

Assessment Questions

Students could communicate their observations.

Will an object float or sink on oil or on water?

Materials

Clear plastic cups
Collections of everyday objects (paper clip, button, penny, marble, eraser, paper, leaf, fabric, etc.)
Oil
Water

Procedure

1. Organize the students in groups of three or four. Provide each group with a tall, clear cup filled with oil and water, and a collection of everyday objects the students have gathered.
2. Have the students carefully place the objects in the glass and record the results.
3. After all the students have had an opportunity to test all the objects, discuss, as a class, what they have observed.

Extension

Complete the same activity using other liquids, e.g., honey, vinegar, dish detergent, shampoo, molasses.

Activity 23: Mixing Solids and Liquids

Assessment Students could communicate their observations. They could also complete a journal page by drawing and writing about what they saw after they mixed the solid and the liquid.

Questions Do all solids and liquids mix?

Materials

Clear plastic cups
Water
Salt
Sand
Wooden stir sticks

Procedure

1. Organize the students into groups of three or four. Discuss the term **dissolve**. Provide each group with three clear cups filled with water, and small containers of sand and salt (film canisters are good for this).
2. Have the students mix the salt in one glass of water and record their findings. Then have them mix the sand in the second glass of water and record their findings. The third glass of water is used to compare. The students may find it helpful to label their cups as they create their mixtures.
3. After all the students have had an opportunity to test all the solids and record their observations, the class can discuss their findings.

Extension Complete the same activity using other solids, e.g., rice, beans, powdered drink mix, flour, pepper, coffee beans. Complete the same activity testing solids in other liquids.

Activity 24: Can You Design a Boat That Will Float a Cargo?

Assessment

Students are able to communicate their observations by completing journal entries describing their boat design using both illustrations and writing. They are able to complete a journal page by drawing and writing about what happened when they tested their boat design. In groups, students are able to orally present their boat design and findings to the class.

Questions

What type of boat will hold the most cargo?
What shape was the boat that held the most cargo?

Materials

Large buckets/containers
Water
Materials to use to build the boats/rafts (clay, linking cubes, aluminum foil, empty milk containers, etc.)
Cargo (pennies, linking cubes, etc.)
Science journal

Procedure

1. This activity may take several classes to complete. First ask your students to predict if the cargo you have chosen will sink or float. Demonstrate that the cargo will sink.
2. Organize the class into small groups then challenge the students to design a boat/raft that will float the cargo using the materials provided. Encourage them to think about what they may know about the materials by thinking about some of the recent liquid and solid explorations we have done. Also encourage them to be creative.
3. Have the students decide on the material(s) they want to use, design the boat, draw, and write about what they have done. What material did they use? Why did they choose that material? Is the bottom flat? How tall are the sides?
4. Then have the students test their boats in containers of water. Have them record whether or not their boat floated and how much cargo it would hold before it sunk.
5. Have the students share their boat designs and findings with the class.

Extension

Have the students draw and write how they could redesign their boat/ raft to make it better. Then have them redesign their boats and test the results.

Activity 25: Magic Mud

Assessment Students could communicate their observations by orally sharing their observations with the class and by completing a journal page.

Questions Do you think it is a liquid or a solid?

Materials
Wide plastic tubs (large margarine containers or sour cream containers)
Water
Measuring cups
Spoons/stir sticks
Cornstarch
Recipe cards (if you need them, see procedure)
Paper towel

Procedure

1. Divide the class into partners or small groups and tell them they are going to mix some liquids and solids together to make something new—magic mud.
2. Give each group a plastic container, a measuring cup, water, and cornstarch. Have them follow the magic mud recipe that can be written out on the board or given to each group on a recipe card (you may want to discuss with the class how to read a recipe). As the students are working, circulate and listen to the discussions. You can ask the students the following questions as you are circulating:
3. Do you think the mixture is a liquid or a solid?
4. What makes you think this?
5. What happens when you squeeze it in your hand?
6. What happens when you hold mixture loosely?
7. Have the students complete a journal page about their magic mud discoveries. Invite the students to share and discuss what they have discovered.

Magic Mud Activity

Ingredients

- 75 ml cornstarch
- 45 ml water

Directions

Place cornstarch in medium-sized container. Add water and mix.

- Play with the mixture with your hands.
- Squeeze the mixture then let go. What happens?
- How does the mixture feel when you squeeze it?
- How does the mixture feel when you let it go?

Activity 26: How Water Can Be Cleaned

Assessment Students could communicate their observations. They could also share their discoveries in a whole-class discussion at the end of the lesson.

Questions How were you able to make the water cleaner?

Materials
Clear jar/container (two per group)
Water
Pollutants (e.g., leaves, twigs, grass, rocks, plastic foam bits, cooking oil)
Strainers (one per group)
Plastic spoons
Paper towel

Procedure

1. Discuss water pollution with the students. How does water become polluted and what does it do to our environment? Organize the class into small groups. Give each group a jar/container filled with polluted water, spoons, a strainer, paper towel. Discuss ways that the students might use the materials to clean the water. Have the students draw a picture of their polluted water then have them work together to clean the water.
2. Each time they do something to clean the water, have students record their observations by drawing a picture of what the water looks like. After the students have finished cleaning the water, have them compare their clean water. Have the class discuss how difficult water would be to clean once it is polluted.

Appendix D
Experiences for Physical Science: Relative Position and Motion

Activity 27: Position

Assessment

Students are able to describe the position of objects.
Students are able to answer questions that arise from viewing the position of objects from different perspectives.

Questions

How did the position of the object change based on the position you viewed it from?
What are some of the words you used to describe the position of various objects?

Materials

Geometric solids
Paper
Pencil

Procedure

Here are words you can use to describe the position of an object:

- behind
- in back of
- beside
- below
- in front of
- under
- inside
- over
- on top of
- underneath
- outside
- above
- left
- right
- middle
- centre

1. Build a model using five pieces from a geometric solids kit.
2. Place it in the middle of your desk.
3. Sit behind your desk and draw your model carefully.
4. Do not move your model.
5. Now sit in front of your desk and draw your model again.
6. Write about the ways your drawings are different.

Activity 28: Using Ramps

Assessment

Students are able to record their results in their journals.
Students are able to describe what they observed.

Questions

Which bottle will travel the greatest distance from the base of the ramp?
Do some bottles roll better than others? How could you tell?

Materials

Ramps
Blocks
Bottles with caps
Journals

Procedure

1. This activity should be done following students' investigations of ramps. Once they have seen how soup cans will roll, have them bring in a 2-L pop bottle filled with something (not a liquid) of their choice, e.g., crayons, marbles, sand, or rocks.
2. Put the cap on the bottle.
3. Set up two ramps. Have students take turns releasing their bottles. Measure distances/observe results. Do some bottles roll better? Was each bottle filled to the top or partly filled and did this affect the results? For example, marbles may roll around inside if the bottle is not filled to the top and would affect the way it rolled.

Activity 29: Building a Downhill Racer

Assessment

Observe students' participation. Each team collaborates to design and build their racer.
Students are able to build a racer.
Students are able to design a fair test using their racer.

Questions

How do I build a downhill racer that works effectively?
What is a fair test?

Materials

Ramps
Blocks
Suitable building supplies

Procedure

1. Introduce this activity once students have had a chance to explore ramps and rollers.
2. Provide teams of students with building materials (found or kits of building supplies) to build their racers.
3. Hold this event in a hallway or gymnasium where a number of similar ramps (fair testing) can be assembled, facing one direction.
4. Challenge teams to design, test, and modify to create the best racer.

Activity 30: Collecting Evidence

Assessment Students should be able to apply the principles of fair testing to other problems.

Questions
What affects the motion of my object?
What tools can I use to collect data about my test?
What evidence do I have to show that my test was fair?

Materials
Ramps
Blocks
Rollers
Measuring tape
Pencil
Paper

Procedure
1. Student teams can identify factors that will affect the motion of their object. They can decide which to test.
2. Make predictions.
3. Record their results.
4. Discuss, as a team, what makes their procedure "fair."
5. Discuss, with the class, each group's procedures, tools, and evidence for their object.
6. Make a class data table.