Science 4 / Science 5

HANDBOOK FOR TEACHING COMBINED CLASSES

NOVA SCOTIA

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Contents

Introduction

This resource has been written and designed as a handbook for teachers who have combined science classes of grades 4 and 5 students.

In conjunction with this handbook, please consult and use *Atlantic Canada Science Curriculum: Grade 4* and *Atlantic Canada Science Curriculum: Grade 5*.

Teachers of combined classes in the same school as teachers of individual grades need to be aware of the topics addressed in each grade's classrooms, to ensure that their students will be exposed to all of the topics in the Atlantic Canada science curriculum guides for these grades.

We suggest that teachers become very familiar with the expectations of the grades 4 and 5 Atlantic Canada science curriculum guides, as well as this handbook, prior to implementing the units. Helpful hints, required materials, assessment tools, procedures, samples of recording sheets, resource suggestions, technological supports, students' work samples, outcomes, and questions have been provided to assist teachers in designing instruction.

Overview

Atlantic Canada Science Curriculum: Grade 4 comprises four units: Habitats; Light; Sound; and Rocks, Minerals, and Erosion. *Atlantic Canada Science Curriculum: Grade 5* comprises three units: Weather, Forces and Simple Machines; Meeting Basic Needs and Maintaining a Healthy Body; and Properties of and Changes in Materials.

To support instructional planning, this resource includes examples of yearly plans as a complement to the curriculum guides. A yearly plan is the organization of a sequence of outcomes clustered together in various ways to maximize connections within science, between science and other disciplines, and to the world beyond the classroom. Yearly plans encourage you to develop time lines that help ensure that students have opportunities to achieve all of the outcomes. The examples of yearly plans in this resource are intended to be suggestions only. Develop your own yearly plans to suit your situation and organizational preferences.

Map out how you would like to section the school year into intervals of time (e.g., months, terms, reporting periods). Listed in Appendix A are the specific curriculum outcomes for grades 4 and 5. Outcome cards are available electronically for Nova Scotia teachers at http://educators.EDnet.ns.ca. These allow clustering of all of the outcomes so that you can effectively map out the learning and teaching that will happen in your classroom. Mapping out the year in this way makes it easier to visualize the clustering of the different outcomes from various subjects and is an excellent organizational tool to assist you in planning the year.

This handbook offers a two-year plan for teachers to address the outcomes for each grade. It is recommended that the school make a plan for combined classrooms. The two-year plan should alternate to provide students with the outcomes for Science 4 and Science 5. In grades 4–5 classrooms science outcomes are achieved through a blending of the science units.

Remember that science at these levels is hands-on, minds-on, so students are able to know and do science effectively in a combined classroom. Students then advance to the next grade with knowledge, skills, and attitudes gained through experiences that give them a solid background in scientific inquiry. From grades primary to 6, students require a minimum of 60 percent of science time to be actively involved in hands-on, minds-on learning experiences. Students need to explore, examine, explain, and evaluate science in their world. A combined classroom offers exciting opportunities for students to become scientifically literate and behave as young scientists.

A hands-on, minds-on science classroom engages students in questioning, investigating, and discovering science for themselves. For young scientists the process of hands-on, minds-on science models what a scientist does and requires them to use their skills to go through the processes of science. This cements the connections of science to the students' world. Science learning also provides opportunities for reading, writing, and mathematics in context.

Instructional Planning

Use this handbook, together with *Atlantic Canada Science Curriculum: Grade 4* and *Atlantic Canada Science Curriculum: Grade 5*, as a tool to assist you in planning to address the outcomes in a combined-class setting.

The following sample of a two-year plan includes the units from grades 4 and 5. All outcomes from each grade are addressed each year so that both grade 4 and grade 5 students address the outcomes for their grade level.

The school plan for combined classes allows teachers to choose either Year 1 or Year 2 and then continue to alternate the plans each year.

Sample Outline: Two-Year Plan

Year 1	Year 2
Component 1: Light in Action	Component 1: Weather (All Year)
Component 2: Sound in Motion	Component 2: Body Systems (All Year)
Component 3: Rockin' Weather	Component 3: The World We Live In
Component 4: My World, My Body	Component 4: Machines on the Move

Year 1: Sample Plan

Four Components for a Science 4 and Science 5 Combined Class

Component 1: Light in Action	Addresses outcomes in Science 4: Light Science 5: Properties of and Changes in Materials
Component 2: Sound in Motion	Addresses outcomes in Science 4: Sound Science 5: Forces and Simple Machines
Component 3: Rockin' Weather	Addresses outcomes in Science 4: Rocks, Minerals, and Erosion Science 5: Weather
Component 4: My World, My Body	Addresses outcomes in Science 4: Habitats Science 5: Meeting Basic Needs and Maintaining a Healthy Body

Component 1: Light in Action

Preparation Suggestions

- Provide an interest table (e.g., camera; binoculars; periscope; kaleidoscopes; prisms; telescopes; flashlights; Intel Play microscopes; hand lenses; mirrors; materials that are translucent, transparent, and opaque).
- Investigate students' prior knowledge.
- Refer to the equipment lists found in *Atlantic Canada Science Curriculum: Grade 4* and *Atlantic Canada Science Curriculum: Grade 5*.
- Select appropriate resources from the school library.
- Reserve videos from the Learning Resources and Technology Media Library.
- Book Nova Scotia Museum classes, if available in your area.
- Investigate appropriate speakers (e.g., an optometrist to discuss physical changes in the eye after laser surgery, a photographer, an artist).
- Develop a topic vocabulary. Collect topic books.
- Collect equipment. See *Atlantic Canada Science Curriculum: Grade 4*, pages 93–98. Also, collect aluminum tart cups, ammonia (15 mL), antacid tablets, baking soda, biodegradable cups, charcoal briquettes, cornstarch, cotton swabs, flour, foil plates, food colouring, iodine, lemon juice, liquid bluing (60 mL), magnifying glasses, mini marshmallows, modelling clay, plastic sandwich bags, raisins, safety goggles, salt, skim milk, steel wool, sugar, sugar cubes, test tubes, a thermometer, vegetable oil, and vinegar.
- Reserve materials from your school board Teacher Centre, if available.

- Plan a field trip to the Discovery Centre. Book hands-on sessions in addition to a general visit.
- Plan local field trips (e.g., to an optometrist).
- Review the safety guidelines found in the Department of Education's *Science Safety Guidelines, Grades Primary–12*.

Making a Print

Question

- Will sunlight cause a change on photographic paper?

Materials

- collection of objects that will leave a clear image (e.g., leaves, keys, scissors)
- photographic paper (look at supplier catalogues)

Procedure

On a sunny day, invite students to predict what changes, if any, the sunlight will have on the photographic paper. Take students outside and set up the experiment. Follow the directions on the package of photographic paper. Students should include the photographic paper with a write-up in their science journals.

Outcomes

Students will be expected to

Science 4

investigate and predict how light interacts with a variety of objects (including changes in the location, shape, and relative size of a shadow) in order to determine whether the objects cast a shadow, allow light to pass, and/or reflect light (303-4, 303-5)

Science 5

observe and identify changes in an object's appearance, state, and/or reversibility and classify it as a physical change or not (301-9, 205-5, 301-10)

Water, Light, and Changes

Questions

- What do the terms **opaque**, **translucent**, and **transparent** mean?
- What will happen to the materials when droplets of water are added?
- What is a prism?

Materials

- clear plastic wrap
- foil wrap
- overhead projector
- tissue paper
- water
- water dropper

Procedure

Invite students to predict the changes in materials once droplets of water have been added. What effect does light have on these materials? Allow students an opportunity to observe what will happen to materials on the overhead-projector screen when droplets of water are added. Discuss the characteristics of a prism and the changes that have occurred. Have students record the observations in a science journal and share the results.

Outcomes

Students will be expected to

Science 4

classify objects as opaque, transparent, or translucent (206-1)

demonstrate that white light can be separated into colours (dispersion) and follow a set of procedures to make and use a colour wheel (104-6, 205-3, 303-7)

Science 5

observe and identify changes in an object's appearance, state, and/or reversibility and classify it as a physical change or not (301-9, 205-5, 301-10)

Light and Liquids

Questions

- Will light travel through all liquids?
- What are the properties of a liquid?

Materials

- clear and coloured water
- clear containers
- flashlight
- milk

Procedure

Examine and discuss the differences and similarities between the three liquids. Have students predict which liquids will allow light to pass through them. Direct students to shine the light through the liquids and to record what they observe. Have students create their own chart and record the properties of liquids. Refer to *Atlantic Canada Science Curriculum: Grade 5*, p. 180.

Outcomes

Students will be expected to

Science 4

classify objects as opaque, transparent, or translucent (206-1)

Science 5

classify materials as solids, liquids, or gases and illustrate this classification in a property chart (206-1, 300-9)

Light with Ice and Water

Questions

- What are the differences between the molecules in a solid and a liquid?
- Does light travel through a clear solid?
- Does light travel through a clear liquid?

Materials

- flashlight
- frozen samples in clear containers
- Intel Play microscope

Procedure

Freeze enough samples to distribute to groups of students. Discuss the differences between the **liquid** (water) and the **solid** (ice), using the microscope. Students should record the findings in their science journals. Allow students an opportunity to shine light through each and to record and discuss the observations, comparing the ice and water.

Melt the ice and repeat the experiment. Shine light through the ice water and ask students to determine if there is a difference between the melted ice water and the water that has not been frozen.

Outcomes

Students will be expected to

Science 4

investigate and predict how light interacts with a variety of objects (including changes in the location, shape, and relative size of a shadow) in order to determine whether the objects cast a shadow, allow light to pass, and/or reflect light (303-4, 303-5)

Science 5

observe and identify changes in an object's appearance, state, and/or reversibility and classify it as a physical change or not (301-9, 205-5, 301-10)

Light and Chemical Changes

Questions

- How can we explore chemical changes that can be reversed?
- How can we explore chemical changes that cannot be reversed?
- Are there chemical changes that cause light to be emitted?

Materials

- aluminum pie plate
- baking soda
- jar
- lighter/matches
- mortar and pestle
- New Year's crackers
- oven
- plaster of Paris
- plastic dish pan
- sticks that glow
- tea lights
- vinegar
- water

Procedure

Part 1: Groups of students will mix plaster of Paris with a small amount of water to make a paste. The paste should be placed into the pie plate and allowed to harden. Make observations about its appearance and any changes in temperature as it hardens. This may take several hours. After hardening, the plaster can be put into an oven set at 300°F for about an hour. This resting time will draw the water component out of the plaster and students should be able to grind it (with a mortar and pestle) back into the powder form—a reversible reaction.

Part 2: Activate the sticks that glow, New Year's crackers, and tea lights. Observe and discuss the reversible reaction.

Part 3: Mix small amounts of vinegar and baking soda together in a small jar. Have a plastic dishpan available for the overflow. Once the vinegar and baking soda "erupts," observe and discuss.

Outcomes

Students will be expected to

Science 4

plan an investigation and communicate questions and ideas with others about light emitted from an object, its own or an external source (204-7, 207-1, 303-3)

Science 5

work with team members to develop and carry out a plan to distinguish a material based on its chemical properties and display the results of the data (204-7, 207-3, 206-2, 204-5)

describe and give examples of the interactions among materials, including gases, and discuss their properties (301-11, 301-12)

Mass and Shadows

Questions

- Does a change in the shape of an object change its shadow?
- Does the shape of an object affect its mass?

Materials

- Activity Sheet:
  Mass of the Parts of Objects
- Cube-A-Links
- overhead projector
- scale

Procedure

Using the overhead projector, create a figure with Cube-A-Links. Observe the shadow of the shape on the overhead-projector screen. Experiment by moving the shape to see the changes in the shadow. Ask students to find the mass of the Cube-A-Links figure and record it. Rearrange the same number of cubes. Observe this shadow. Ask students to find the mass of the second figure and record it. Separate the cubes and observe the shadows of the individual cubes. Have students total the mass of all of the separated cubes and record their results. Has the mass changed?

Outcomes

Students will be expected to

Science 4

investigate and predict how light interacts with a variety of objects (including changes in the location, shape, and relative size of a shadow) in order to determine whether the objects cast a shadow, allow light to pass, and/or reflect light (303-4, 303-5)

Science 5

follow a given set of procedures to relate the mass of a whole object to the sum of the masses of its parts and suggest possible explanations for variations in the results (104-5, 205-3, 300-11)

Activity Sheet: Mass of the Parts of Objects

Mass of the Parts of Objects

Object	Total mass of the object	Masses of the object's parts	Difference in the masses
Water	Mass of water and container prior to being frozen	Mass of water and container after turning to ice	

How did the mass of the total object differ from the masses of its parts?

_____

What might have caused the differences if there were any?

_____

Illustration of one of the objects being measured:

Related Occupations and Technologies

Questions

- What careers and occupations use optical devices?
- How has light improved our living conditions?

Materials

- books
- contact lenses
- computers with Internet access
- eyeglasses
- guest speakers
- low-energy light bulbs
- solar panels
- video games

Procedure

Have students make a list of, and then research online, occupations and technologies that have benefited and improved our lives (e.g., laser surgery, contact lenses, solar panels, computer monitors, video games, low-energy light bulbs) and also human and animal ear design. Schedule presentation times for students.

Outcomes

Students will be expected to

Science 4

identify women and men in their community who have careers using optics (107-10)

describe and illustrate how the human ear is designed to detect vibrations and compare the range of sound heard by humans to that heard by some animals (300-3, 300-4)

identify examples of current sound research and technology, including Canadian contributions (105-1, 107-12, 205-8)

Science 5

use a variety of sources and technologies to identify and describe the source of the materials found in an object, changes to the natural materials required to make the object, and how manufactured materials have been developed to improve living conditions (107-8, 205-8, 300-12)

ACTIVITY 8

Light and Optical Devices

Questions

- What did it feel like when you were unable to see in the dark?
- How do we depend on light in our everyday experiences?

Materials

- cornstarch
- flat and crumpled paper
- flour and dough
- ice and steam
- mixture of cornstarch and water
- one clean blindfold per student (an old sheet cut up)
- recording sheet (*Atlantic Canada Science Curriculum: Grade 5*, p. 176)
- variety of materials that have undergone a physical change (e.g., unpopped and popped corn)
- water

Procedure

Have students, working with a partner (one blindfolded and one leading the way), take turns feeling a variety of materials that have undergone a physical change. When the blindfolds have been removed, have the partners discuss and describe what the objects felt like when the students were blindfolded and classify the materials as solids, liquids, and gases. Discuss, as a class, the changes that occurred in each example.

Outcomes

Students will be expected to

Science 4

describe properties of light that have led to the development of optical devices that enhance our ability to observe (106-1, 106-4)

Science 5

work with team members to develop and carry out a plan to distinguish a material based on its chemical properties and display the results of the data (204-7, 207-3, 206-2, 204-5)

Examining Physical Changes

Questions

- How does the absence of light affect a variety of objects?
- What are some examples of reversible and irreversible physical changes?

Materials

- computers with Internet access
- mirrors
- periscopes
- plants
- solar calculators
- water

Procedure

Have students, through research and discovery, examine a variety of physical changes that occur in the absence of light:

- With the lights on and off, have students look at their reflection in water with a mirror.
- Observe the growth of two similar plants, one in sunlight, one in a dark box.
- Use solar-powered calculators in a light room and dark room.
- Research how solar-heated pools work, how periscopes work, night-vision driving, and nocturnal animals.
- Discuss objects that emit their own light and those that depend on another light source.

Outcomes

Students will be expected to

Science 4

plan an investigation and communicate questions and ideas with others about light emitted from an object, its own or an external source (204-7, 207-1, 303-3)

Science 5

describe and give examples of the interactions among materials, including gases, and discuss their properties (301-11, 301-12)

ACTIVITY 10

Investigating Optical Devices

Questions

- What materials can be used to make a variety of optical devices?
- How does light make each device work?
- Which objects emit their own light and which objects depend on another light source?
- What technological advancements have been made to light to improve our lifestyle?

Materials

- 3-D glasses
- binoculars
- cameras
- concave and convex mirrors and lenses
- contact lenses
- craft supplies
- eyeglasses
- flashlights
- hand lenses
- Intel Play microscope
- kaleidoscopes
- mirrors
- night-vision glasses
- periscope
- prisms
- sunglasses
- telescopes

Outcomes

Students will be expected to

Science 4

plan an investigation and communicate questions and ideas with others about light emitted from an object, its own or an external source (204-7, 207-1, 303-3)

compare and describe how light interacts with a variety of optical devices and construct an optical device that performs a specific function (107-1, 205-10, 303-8)

Science 5

use a variety of sources and technologies to identify and describe the source of the materials found in an object, changes to the natural materials required to make the object, and how manufactured materials have been developed to improve living conditions (107-8, 205-8, 300-12)

Procedure

Ask students to work in pairs to compose lists of the materials needed to manufacture the devices on display and make presentations of what they've discovered. Have similar materials been used in all of the devices? Have students hypothesize how light makes each device work.

Have students use the provided materials to construct an optical device (e.g., a kaleidoscope).

Discuss with the class which objects in our universe emit their own light and which ones depend on a light source.

Ask students to research and discuss what technological advancements have been made to improve our lifestyle (e.g., lasers, computers, solar-powered devices).

Objects That Absorb, Transmit, and/or Reflect Light

Questions

- Which objects absorb, transmit, and/or reflect light?
- Which objects are **opaque**, **transparent**, or **translucent**?
- Does the size or form of the material in the object change when light passes through it?
- If so, is the change reversible?
- Can light make a physical or chemical change to an object?

Materials

- Activity Sheet: Opaque, Transparent, and Translucent
- Activity Sheet: Translucent and Opaque
- Activity Sheet: Light Sources
- *Atlantic Canada Science Curriculum: Grade 4*
- various materials to classify

Procedure

Refer to pages 48–51 of *Atlantic Canada Science Curriculum: Grade 4*. Discuss light in relation to physical and chemical changes (e.g., light shining on a piece of coloured paper, an aluminum-foil surface, sunlight reflected off a mirror onto paper).

Ask students to complete the three activity sheets on pages 23–25.

Outcomes

Students will be expected to

Science 4

investigate and predict how light interacts with a variety of objects (including changes in the location, shape, and relative size of a shadow) in order to determine whether the objects cast a shadow, allow light to pass, and/or reflect light (303-4, 303-5)

classify objects as opaque, transparent, or translucent (206-1)

Science 5

observe and identify changes in an object's appearance, state, and/or reversibility and classify it as a physical change or not (301-9, 205-5, 301-10)

Activity Sheet: Opaque, Transparent, and Translucent

Types of Light You Tested

List the objects under the following headings:		
Opaque	Transparent	Translucent

Characteristics of an object that is opaque:

_____

_____

_____

Characteristics of an object that is transparent:

_____

_____

_____

Characteristics of an object that is translucent:

_____

_____

_____

Activity Sheet: Translucent and Opaque

Objects and Their Characteristics

Objects that allowed light to travel through them:	Characteristics of the objects that allowed light to travel through them:
Objects that did not allow light to travel through them:	Characteristics of the objects that did not allow light to travel through them:

Illustration of an object and its shadow when light was directed at it:

Activity Sheet: Light Sources

Decide whether the following emit their own light or if they need a light source to be seen.

Object	Emits light	Needs a light source to be seen
Moon		
Laser		
Light bulb		
Fire		
Candle		
Window		
Sun		
Watch		

Bending Light

Questions

- How could you show that ordinary light is made up of different colours?
- How does a physical change make a difference in the appearance of an object?
- What predictions can you make about the path of light?
- What does the term **disperse** mean?
- How has light improved our quality of life? Discuss.

Materials

- Activity Sheet: Bending Light
- various materials to put in the water such as a penny, pencil, sponge
- glass
- water

Procedure

- Students can use the water glass to determine how the object looks in and out of the water.
- Students should observe the colour of the object in and out of the water. Ask students to determine if there is a physical change to any of the objects.
- Students should observe how light travels through water.
- Have students record how different optical devices help us see things.

Connections

Investigate the work of Louis Braille and examine how materials have been altered to assist visually impaired and blind people. Look at and create examples of the Braille alphabet.

Outcomes

Students will be expected to

Science 4

demonstrate and describe how a variety of media can be used to change the direction of light (303-6)

demonstrate that white light can be separated into colours (dispersion) and follow a set of procedures to make and use a colour wheel (104-6, 205-3, 303-7)

observe, demonstrate, and make conclusions about how light travels and is dispersed from a variety of light sources (206-5, 303-2)

Science 5

observe and identify changes in an object's appearance, state, and/or reversibility and classify it as a physical change or not (301-9, 205-5, 301-10)

use a variety of sources and technologies to identify and describe the source of the materials found in an object, changes to the natural materials required to make the object, and how manufactured materials have been developed to improve living conditions (107-8, 205-8, 300-12)

Activity Sheet: Bending Light

Bending Light: Optical Devices

Optical device	How it helps us see things	Where/how the device is used

Choose an optical device and describe how it has helped us.

_____

_____

_____

_____

Component 2: Sound in Motion

Preparation Suggestions

- Provide an interest table.
- Investigate students' prior knowledge.
- Develop a vocabulary.
- Refer to the equipment lists found in *Atlantic Canada Science Curriculum: Grade 4* and *Atlantic Canada Science Curriculum: Grade 5*.
- Reserve videos from the Learning Resources and Technology Media Library.
- Reserve materials from your school board Teacher Centre, if available.
- Investigate appropriate speakers (e.g., APSEA teacher, arborist, audiologist, bus driver, computer technologist, heavy-machine operator, landscaper, truck driver).
- Review the safety guidelines found in the Department of Education's Science *Safety Guidelines, Grades Primary–12*.
- Use the books available in your classroom that complement this component.
- If available, use the school library resources. See the resources list in Appendix E.

Machines Make Sounds

Question

- Can we identify machines by their sounds?

Materials

- Activity Sheet: Name That Sound
- blank audio cassettes
- tape recorders that can be loaned to students

Procedure

Ask students to make an audio recording at home of several machine sounds. Provide sharing and guessing opportunities.

Have students work in groups of three or four to pretend to be a machine that makes one of the sounds. Share. Discuss some parts of the machines and their purposes.

Outcomes

Students will be expected to

Science 4

identify objects by the sounds they make and describe examples of devices that enhance our abilities to hear and collect sound data (106-1, 107-1, 303-9)

Science 5

design a system of machines to solve a task (204-7)

Activity Sheet: Name That Sound

Sound

Description of the sound	What made the sound?	Illustration of the item that made the sound

How do we depend on our hearing to identify sounds?

_____

_____

_____

Take two of the above sounds and tell whether it is important that they can be heard or not. Explain your answer.

_____

_____

_____

Designing Musical Instruments

Questions

- What is friction?
- How can we modify the pitch and loudness of sounds?

Materials

- Activity Sheet: My Musical Instrument (The Design)
- balloons
- blocks of wood
- bottles of water/ empty bottles
- boxes
- cymbals
- hair combs
- rice
- rubber bands
- sandpaper
- waxed paper

Encourage students to be creative in their choice of materials for their instruments.

Procedure

Develop vocabulary (e.g., **friction**, **force**) through demonstrations and activities. Design musical instruments that include the components of friction and force (e.g., rubbing sandpaper blocks together, drumming on different surfaces, clanging cymbals, forcing air through tubes, scraping hair combs over different surfaces, pinging rubber bands). Design an investigation to lift or pull a drum, a piano, or a tuba. Discuss the force needed to lift or pull, and the units involved.

Discuss and demonstrate sounds that represent force and/or friction, which sounds are high-pitched, and which are loud or soft.

Practise a well-known tune together as an orchestra. Keep in mind that some parts of the tune are soft and some are loud.

Outcomes

Students will be expected to

Science 4

demonstrate and describe how the pitch and loudness of sounds can be modified; design, construct, and evaluate a device that has the ability to create sounds of variable pitch and loudness (104-1, 205-2, 206-7, 301-3)

Science 5

investigate and compare the effect of friction on the movement of objects over a variety of surfaces (204-1, 204-5, 303-15)

perform experiments to describe the force needed to lift or pull a given load in standard and non-standard units (205-4, 205-5, 205-6)

use simple machines to identify the effort and load required to move objects (205-2, 206-9, 303-17)

Activity Sheet: My Musical Instrument (The Design)

Name of the instrument: _____

Materials needed to make it: _____

_____

How it will produce sound: _____

How the pitch of the musical instrument will be changed:

_____

_____

How the loudness of the musical instrument will be changed:

_____

_____

How does the force needed to lift or pull a large instrument work?

_____

_____

Illustration/diagram of the proposed instrument:

The Human Machine

Questions

- How do simple machines work?
- How can simple machines be combined to create complex machines?
- How can the loudness and pitch of sounds be modified?
- How do forces help with the sounds?

Materials

- axles
- cymbals
- posters and books on simple and complex machines
- rhythm sticks
- variety of sizes of wheels
- wooden dowels

Procedure

Have students, in small groups, become parts of one machine. Their movements and sounds should be connected to one another and create a definite rhythm. Students should be encouraged to create variations in volume and pitch. Students should discuss what forces are used and how they hold objects in place. Students should discuss how the human machine uses simple mechanics (like a lever) to move objects.

This activity should be done at the conclusion of the unit. The students will have developed an awareness of sound and the components of complex machines. Have each group member illustrate his or her machine and label its parts.

Outcomes

Students will be expected to

Science 4

demonstrate and describe how the pitch and loudness of sounds can be modified; design, construct, and evaluate a device that has the ability to create sounds of variable pitch and loudness (104-1, 205-2, 206-7, 301-3)

Science 5

demonstrate the use of rollers, wheels, and axles in moving objects (303-16)

observe, investigate, and describe how forces can act directly (contact) or from a distance (non-contact) to move or hold objects in place (303-12, 303-13)

design a lever for a particular task and differentiate between the positions of the fulcrum, the load, and the effort (303-18, 303-19)

Machines and the Human Voice

Questions

- How can the human voice be altered?
- What machines can alter the human voice?
- How have machines that are connected with sounds improved living conditions?

Materials

- cellphones
- hearing aids
- megaphone
- microphone
- PA system
- recording device
- walkie-talkies

Procedure

Have students use machines/technology to investigate how the human voice can be altered (e.g., speak into a megaphone or microphone, leave a voice message on an answering machine, listen through a hearing aid, have conversations using walkie-talkies and cellphones).

Examine and discuss ways in which machines that are connected with sounds have improved living conditions. Refer to Objects That Make Sounds, *Atlantic Canada Curriculum Guide: Grade 4*, pages 58–59.

Connections

Write a script that reflects appropriate conversations for a walkie-talkie or a monologue using a microphone.

Outcomes

Students will be expected to

Science 4

identify objects by the sounds they make and describe examples of devices that enhance our abilities to hear and collect sound data (106-1, 107-1, 303-9)

Science 5

describe examples of how simple machines have improved living conditions and identify machines that have been used in the past and that have developed over time (105-5, 107-8, 205-8)

Watching Sound Waves

Question

- Through which materials do sound waves travel the best?

Materials

- aluminum foil
- fabric
- foil plates
- plastic plate
- radio (boom-box type) or computer speaker
- rice
- thin and thick paper plates
- wood

Procedure

Position the radio so the speakers are facing upward. Place rice grains on a paper plate and put the plate on top of the speaker. To illustrate that force can move objects, gradually increase the volume so the students can see the rice grains "dance." Use other materials such as aluminum foil, fabric, wood, and a plastic plate and repeat the experiment. Have students record the differences on a chart. Students should make the connection that the louder the volume, the greater the movement of rice. They should make the connection that sound waves travel best through thin materials. The force of the sound waves emitted from the speaker has a direct connection to how much the rice moves.

Explore other ways in which force can move objects.

Outcomes

Students will be expected to

Science 4

relate vibrations to sound production and compare how vibrations travel differently through a variety of materials (303-10, 303-11)

Science 5

demonstrate and describe the effect of increasing and decreasing the amount of force applied to an object (303-14)

Sound Waves In and Out of Water

Questions

- How does a single pulley system use more or less effort than a multiple pulley system?
- How does sound travel in water?

Materials

- large water containers
- pulley systems
- variety of non-soluble materials to create simple machines

Procedure

Part 1: Have students, working in small groups, design a simple machine (using non-soluble materials) to compare sound variations in and out of water. The machine needs to make its own sound. Have students submerge machines into water using a pulley system and, as a group, predict whether this job would be easier if more than one pulley were used. Test and record the results.

Part 2: Review how sound travels. Research and discuss how whales and bats use sonic vibrations to locate objects. Research man-made devices (e.g., fish-locating devices) based on this premise.

Outcomes

Students will be expected to

Science 4

relate vibrations to sound production and compare how vibrations travel differently through a variety of materials (303-10, 303-11)

Science 5

compare and record the force needed to lift and load an object by using a single pulley system with that needed to lift it by using a multiple pulley system and the effect of adding another pulley or load-lifting capacity (303-20, 204-3)

design a system of machines to solve a task (204-7)

ACTIVITY 19

How Whales Hear

Questions

- How can sound waves travel through string?
- Why are sound waves more visible when string is used?
- Does force affect sound?

Materials

- pieces of string (30 cm in length)
- wire coat hangers

Procedure

Using wire coat hangers, show how whales hear sound waves. Direct students to hit the hanger against a variety of objects, using varying amounts of force. Then, direct students to tie a 30 cm length of string to each bottom end corner of their hanger. Have them use their fingers to put the other ends of the string to the opening of their ears. Students should continue to experiment by hitting objects (e.g., desks, walls, heaters) with varying amounts of force. Have them make comparisons between the two experiments and discuss and record their findings.

Outcomes

Students will be expected to

Science 4

demonstrate and describe how the pitch and loudness of sounds can be modified: design, construct, and evaluate a device that has the ability to create sounds of variable pitch and loudness (104-1, 205-2, 206-7, 301-3)

Science 5

demonstrate and describe the effect of increasing and decreasing the amount of force applied to an object (303-14)

Hearing Hazards

Questions

- Do earplugs affect the sounds we hear?
- What changes have been made over time to improve the noise level made by machines in the workplace?
- How can we protect ourselves against sound pollution?

Materials

- Activity Sheet: Noise Pollution
- cymbals
- earplugs
- egg beater
- hammer
- vacuum cleaner
- whistle
- wood

Procedure

Examine occupations where hearing hazards occur because of noises made by machines (e.g., iPods, industrial vacuum cleaners) or loud factory noises made by machines. Examine how machines (e.g., household vacuum cleaners, dishwashers, range hoods, washing machines) have developed over time to become less destructive to our hearing.

Experiment in the classroom with earplugs. Begin by making noises with a hammer and wood, an egg beater, a whistle, or a vacuum cleaner. Listen to the sounds with and without the earplugs. Compare the results.

Discuss ways in which we can protect our ears.

Outcomes

Students will be expected to

Science 4

use decibel in descriptions of sound intensity while investigating the extent of noise pollution and how to reduce it around them and identify devices that produce loud sounds (104-6, 108-1)

Science 5

describe examples of how simple machines have improved living conditions and identify machines that have been used in the past and that have developed over time (105-5, 107-8, 205-8)

Activity Sheet: Noise Pollution

Noise Pollution

Type of noise pollution	Ways it can be reduced	Ways we can protect our hearing from noise pollution

What is noise pollution?

_____

_____

_____

What impact does noise pollution have on our health?

_____

_____

_____

Component 3: Rockin' Weather

Preparation Suggestions

- Provide an interest table that includes a large variety of rocks from different locations, maps, charts, photographs of eroding cliffs, and/or unique rock formations, and weather instruments (e.g., thermometers, barometers).
- Investigate students' prior knowledge.
- Develop a topic vocabulary.
- Refer to the equipment lists found in *Atlantic Canada Science Curriculum: Grade 4* and *Atlantic Canada Science Curriculum: Grade 5*.
- Reserve videos from the Learning Resources and Technology Media Library.
- Invite a specialist (e.g., rock hound, geologist, biologist) to speak with the class about rocks, erosion, soils, and habitats.
- Bookmark websites related to weather, folklore, rocks, minerals, and erosion.
- Collect *Farmer's Almanac* and books on folklore, rocks, minerals, and erosion.
- Plan field trips to local points of interest. Contact your local tourist/recreation bureau, the Fundy Geological Museum in Parrsboro, and the Nova Scotia Museum. Remind students to be respectful of the environment.
- Review the safety guidelines found in the Department of Education's *Science Safety Guidelines, Grades Primary–12*.
- Consult the school library to collect appropriate resources.

Data Collection

Outcomes

Students will be expected to

Science 4

explore physical properties of local rocks and minerals, using appropriate tools to collect and compare with those from other places (204-8, 205-5, 300-5, 300-6)

Science 5

using correct names of weather instruments, construct and use instruments to record temperature, wind speed, wind direction, and precipitation (104-7, 204-8, 205-4, 205-10, 205-7, 300-13)

Questions

- What do we mean by the term **lustre** as it relates to minerals?
- How does the lustre of a mineral help us to identify it?
- How do we use weather data in our daily lives?
- How do scientists use weather data?
- What type of weather data do we most commonly use?

Materials

- Activity Sheet: Lustre
- Activity Sheet: Hardness

Procedure

Grade 4 students will record mineral data, and grade 5 students will record weather data.

Refer to *Atlantic Canada Science Curriculum: Grade 4*, p. 227 and *Atlantic Canada Science Curriculum: Grade 5*, p. 105.

Activity Sheet: Lustre

Lustre

Sample	Lustre: glassy	Lustre: dull	Lustre: metallic

What do we mean by the term **lustre** as it relates to minerals?

How does the lustre of a mineral help us identify it?

Activity Sheet: Hardness

Use a variety of rock and mineral samples and see whether you can make a scratch mark on them with your fingernail. Sort the minerals and rocks accordingly.

Hardness

Sample	Scratched with a fingernail	Didn't scratch with a fingernail

Which samples do you think were the hardest?

_____

_____

Which samples were the softest?

_____

_____

How did you decide on the answers above?

_____

_____

_____

_____

Poetry Writing

Questions

- Using our senses, what observations can we make about rocks?
- What are the key features of weather systems?

Materials

- paper
- pictures of weather systems
- rocks

Procedure

Grade 4: Rock Poetry: Hand each student a rock. This works best if the students' eyes are closed. Have them think of words and phrases that describe their rock. Have students, with the rock enclosed in their palm, write down the words and phrases and, using what they've written, compose a poem about their rock.

Grade 5: Shape Poetry: Have students write a weather poem in the shape of a weather system (e.g., a poem about a tornado written in the shape of a tornado, a poem about rain written in the shape of a raindrop). Have students write about a folklore example of weather prediction (e.g, little snow/big snow; cows turning their backs to the wind).

Outcomes

Students will be expected to

Science 4

investigate rocks and minerals and record questions and observations (204-1, 205-7)

Science 5

using a variety of sources, gather information to describe the key features of weather systems and identify weather-related technological innovations and products that have been developed by cultures in response to weather conditions (107-14, 205-8, 302-11)

identify and use weather-related folklore to predict weather (105-2)

Field Trip

Outcomes

Students will be expected to

Science 4

describe ways in which soil is formed from rocks and demonstrate and describe the effects of wind, water, and ice on the landscape (301-4, 301-5)

describe natural phenomena that cause rapid and significant changes to the landscape (301-7)

investigate rocks and minerals and record questions and observations (204-1, 205-7)

identify and describe rocks that contain records of Earth's history (300-7)

explore physical properties of local rocks and minerals, using appropriate tools to collect and compare with those from other places (204-8, 205-5, 300-5, 300-6)

demonstrate respect for the local environment (108-3)

Science 5

using a variety of sources, gather information to describe the key features of weather systems and identify weather-related technological innovations and products that have been developed by cultures in response to weather conditions (107-14, 205-8, 302-11)

using correct names of weather instruments, construct and use instruments to record temperature, wind speed, wind direction, and precipitation (104-7, 204-8, 205-4, 205-10, 205-7, 300-13)

Questions

- What effects, over time, does weathering have on the landscape?
- What natural phenomena have caused rapid and significant changes to the landscape?
- What are the characteristics of sedimentary, igneous, and metamorphic rocks?
- How can rocks contain records of the Earth's history?
- How do we classify clouds?
- What weather instruments record wind speed, temperature, wind direction, precipitation, and cloud cover?

Materials

- Activity Sheet: Field Trip: Temperature of Soil and Water
- Activity Sheet: Temperature Change of Soil
- clipboards
- geology-equipment kits (15 geological hammers, 15 safety glasses, 4 gold pans, 2 trowels)
- paper and pencils
- plastic bags
- rock hammers
- safety glasses
- soil and air thermometers

Procedure

Take a local field trip to a location where erosion, rocks, and weathering can be examined first-hand. Invite a specialist along, if possible. Divide the class into two groups. One group will collect rock samples that they believe belong in the three classifications (igneous, metamorphic, and sedimentary). The other group will sketch and label the cloud formations, take soil temperatures from three areas at the location, and collect rock samples that show high and low levels of weathering. Point out areas where the effects of ice, wind, and water on the landscape are visible. Also, point out and identify rocks that contain records of the Earth's history.

Activity Sheet: Field Trip: Temperature of Soil and Water

Soil

Location	Soil temperature (°C)	Air temperature (°C)

Water

Location	Water temperature (°C)	Air temperature (°C)

Properties and Types of Rocks

Properties	**Rock type**
	Igneous
	Sedimentary
	Metamorphic

Activity Sheet: Temperature Change of Soil

Soil Data

Date	Time of day	Location of soil	Air temperature (°C)	Soil temperature (°C)

Illustration of taking the temperature of the soil:

What impact did the air temperature have on the temperature of the soil?

_____

_____

Was the soil temperature different in different areas? If so, what might be the reason for this?

_____

_____

Classifying

Questions

- What are the characteristics of rocks and minerals?
- What are the characteristics of clouds?

Materials

- Activity Sheet: Looking at Rocks and Minerals
- Activity Sheet: Rock Groups
- Activity Sheet: Classifying Clouds
- cloud pictures
- cotton batting
- collection of rocks
- relevant videos

Procedure

Grade 4: Group students and ask them to classify the rocks and minerals in the collection of rocks. Have them create a chart or diagram that illustrates the classification scheme and compare the results (e.g., lustre, hardness, streaking, colour, sharpness, density, texture, magnetism, crystal shape) with those of the other groups.

Grade 5: Have students, using pictures from a variety of books about clouds, identify the types of clouds. If time allows, have students make cloud models using cotton batting. Have students describe how clouds have mass. Have students design an investigation to show how air takes up space and expands when heated.

Outcomes

Students will be expected to

Science 4

classify rocks and minerals by creating a chart or diagram that illustrates the classification scheme and compare results with others (104-4, 206-1, 207-2)

Science 5

identify, classify, and compare clouds (104-4, 206-1)

describe situations demonstrating that air takes up space, has mass, and expands when heated (300-14)

Activity Sheet: Looking at Rocks and Minerals

Each student in the group picks a bag containing a rock or mineral. Compare and talk about your sample with others in your group. Record your observations and vocabulary words below.

After you have completed this activity, make sure that the samples are put back into the correct bag and made ready for the next group.

Rock or Mineral?

Name	Description/discussion/ illustration	Rock or Mineral

Activity Sheet: Rock Groups

Sample number	Properties	Rock type

Explain how the rock samples were sorted.

Activity Sheet: Classifying Clouds

Cloud Classification

Date	Time of day	Type of clouds and illustration

Research Project

Outcomes

Students will be expected to

Science 4

relate characteristics of rocks and minerals to their uses (300-8)

Science 5

identify examples of weather phenomena that are currently being studied (105-1)

describe how studies of the depletion of the ozone layer, global warming, and the increase in acid rain have led to new innovations and stricter regulations on emissions from cars, factories, and other polluting technologies (106-4)

Questions

- How are rocks and minerals used in everyday life?
- How do weather phenomena affect everyday life?
- How do the ozone layer, climate change, and acid rain affect development of new technologies?
- How do cars and factories influence technologies

Materials

- books about rocks and minerals and weather systems
- books about geologists and meteorologists
- computers with access to the Internet
- pictures of rocks and minerals and weather systems
- sheets with descriptions of rocks and how they are classified

Procedure

Grade 4: Have students research five rocks and minerals and record their uses and where and how they are used.

Grade 5: Have students research current weather phenomena (e.g., tsunamis, hurricanes) that are being studied by meteorologists around the world and present a report to the class. Have students investigate the effects of the ozone layer, climate change, and acid rain on their environment. References to innovations and regulations about technologies should be included.

Energy from the Sun

Outcomes

Students will be expected to

Science 4

demonstrate and record a variety of methods of weathering and erosion, including human impact on the landscape (301-6, 108-6)

Science 5

relate the transfer of energy from the sun to weather and discuss the sun's impact on soil and water (206-5, 303-21)

relate the constant circulation of water on Earth to processes of evaporation, condensation, and precipitation (301-13)

Questions

- How have weathering and erosion affected the Earth's landscape?
- What impacts have humans had on the Earth's landscape?
- What is the sun's impact on soil and water?
- What do the terms **evaporation**, **condensation**, and **precipitation** mean?
- What impact does the sun have on our weather?

Materials

- Activity Sheet: Energy from the Sun
- computers with access to the Internet
- guest speaker (e.g., a naturalist, weather-disaster survivor, meteorologist)
- pictures of drought, flooding, tsunamis, etc.
- topic-related videos
- water-cycle diagram

Procedure

Engage students in examining the effects of the transfer of energy from the sun to weather and discuss the sun's impact on soil and water (e.g., the water cycle, evaporation, drought, flooding). This can also be discussed when studying habitats, as climate change is having drastic effects on the habitats around the world. Use the activity sheet to explore energy.

Extension Activity

Read the African legend *The Rainstick, A Fable*, by Sandra Chisholm Robinson, ISBNs: 1560442840, 9781560442844. Make rainsticks using small pebbles and sand.

Activity Sheet: Energy from the Sun

What I know	Questions I might explore	How I might do it

ACTIVITY 27

Make an Anemometer

Outcomes

Students will be expected to

Science 4

examine and investigate, using various methods and questions, local habitats and their associated populations of plants and animals (204-6, 302-1)

Science 5

using correct names of weather instruments, construct and use instruments to record temperature, wind speed, wind direction, and precipitation (104-7, 204-8, 205-4, 205-10, 205-7, 300-13)

Question

- How can we measure the speed of the wind?
- How does the speed of the wind affect habitats?

Materials

- Activity Sheet: Recording Weather Data
- glue gun
- protractors
- string
- table tennis ball
- tape

Procedure

Have students construct an anemometer as follows:

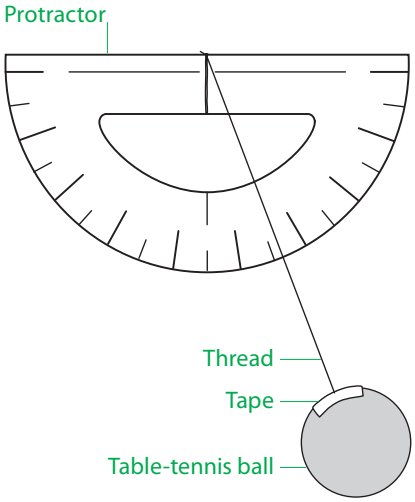
A. Cut a length of string 30 cm long. Tape it to a plastic protractor.

B. Attach the table tennis ball to the other end of the string with tape (students may need teacher help if using a glue gun).

C. Your anemometer is now ready to use. Take it outdoors in an open area where the wind blows. Point the flat edge of the protractor into the wind, holding it away from the body. Note the angle of the string and refer to the table in the activity sheet to determine wind speed.

D. Using a habitat model, describe how the wind may affect a habitat.

You may wish to have each half of the class construct one anemometer so students can compare results. Students should record their results on the activity sheet. Discussions could take place about the effects of wind and the importance of knowing the strength of it.



Activity Sheet: Recording Weather Data

Wind-Speed Table

angle	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20
km/h	0	9	13	16	19	22	24	26	29	32	34	38	42	46	52

Date	Time of day	Amount of rain (mm)	Humidity	Wind speed (km/h)	Air pressure (kPa)	Temperature (°C)	Type of day (e.g., sunny, cloudy)

Component 4: My World, My Body

Preparation Suggestions

- Provide an interest table that includes old X-rays (collected from hospitals), books, bones, exoskeletons of insects, diagrams/posters/skeletal models (from kits), an aquarium, ant farms, brine-shrimp containers, and magnifying lenses.
- Investigate students' prior knowledge through discussion and illustrations, writings, etc.
- Develop a topic vocabulary.
- Refer to the equipment lists found in *Atlantic Canada Science Curriculum: Grade 4* and *Atlantic Canada Science Curriculum: Grade 5*.
- Reserve materials from your school board Teacher Centre, if available.
- Consult the school library to collect appropriate resources.
- Reserve videos from the Learning Resources and Technology Media Library.
- Collect books from personal and local libraries.
- Investigate appropriate guest speakers (e.g., doctor, nurse, paramedic, marine biologist, a representative from Ducks Unlimited).
- Review the safety guidelines found in the Department of Education's *Science Safety Guidelines, Grades Primary–12*.

Comparing Organisms

Outcomes

Students will be expected to

Science 4

classify organisms and draw diagrams to illustrate their role in a food chain (206-1, 302-3)

Science 5

describe nutritional and other requirements for maintaining a healthy body and evaluate the usefulness of different information sources in answering questions about health and diet (206-4, 302-9)

propose questions and carry out procedures to investigate the factors affecting breathing and heartbeat rate, and compile and display data from these investigations in a graph (205-1, 206-2)

Questions

- What is a food chain?
- What foods do humans and other animals or insects require to maintain healthy bodies?
- Where does food come from for humans, other animals, and insects?
- What questions can be investigated about breathing and heartbeat rate?

Materials

- books about animals
- clay
- computers with access to the Internet
- information on insects and food processing (e.g., the path of meat and dairy products from farm to grocery store)
- paper

Procedure

Have students compare the diet of a human to that of another animal or an insect and then make an illustration, 3-D model, or mobile of the food chain for each and compare. Have students share their projects with one another. Have students propose questions to investigate about breathing and heartbeat rate. Have them collect their data, plot a graph, and display the information.

Spider Skeleton / Human Skeleton

Question

- What comparisons can be made between human and spider skeletons?

Materials

- cardboard
- clay or foil wrap
- clear and simple diagrams of skeletons of the human body and spiders
- glue
- large sheets of rolled paper for the background
- markers
- paper-towel and bathroom-tissue rolls
- tape
- wire and wire cutters

Outcomes

Students will be expected to

Science 4

compare the external features, behavioural patterns, structural, and/or behavioural adaptations for an animal to survive a particular habitat, real or imagined (204-3, 300-1, 300-2, 302-2)

Science 5

demonstrate how the skeletal, muscular, and nervous systems work together to produce movement (302-6)

Procedure 1

Hang two large pieces of paper on the wall (from the ceiling to the floor is ideal), apart from each other. Have students collect paper-towel and bathroom-tissue rolls, or recycled rolled paper or newsprint. Using these materials, have each group construct a model of either an anatomically-correct human skeleton or spider skeleton using illustrations/diagrams/pictures as resources. Paper rolls may be glued or taped in place. For the spider the initial step will be to adhere a small, stuffed garbage bag as the body. Have students label all parts on their models.

Procedure 2

Have students build a model of a human skeleton to compare with a model of another animal's or an insect's skeleton. The frames should show movement. Have students use wire for the frames, tape the bottoms to the cardboard for stability, cover the frames with clay or foil wrap, and label and display them.

Technology and Habitats

Outcomes

Students will be expected to

Science 4

describe how scientists' knowledge of plant growth has led to agricultural and technological innovations and the impact on local and regional habitat issues (105-1, 106-4, 108-1)

Science 5

describe examples of medical techniques and technologies developed by Canadians and other cultures that have contributed to the knowledge of body organisms, systems, and health issues (106-2, 106-4, 107-12, 107-14)

Questions

- How has technology had a negative impact on natural habitats?
- How have technological developments had a positive impact on local habitats?

Materials

- computers with access to the Internet
- related non-fiction texts
- videos

Procedure

Using the Internet and texts, direct students to investigate medical techniques and technologies that are related to body organisms and systems and health issues. The information collected should be shared.

Repeat the above procedure for agricultural innovations that have an impact on local and regional habitat issues.

Extension Activity

Have students create a creature that can survive extreme weather and/or environmental conditions.

A Focused Field Trip

Questions

- What evidence can you find that indicates animal life exists in a particular habitat?
- How could humans have a negative impact on this habitat?
- Compare the diet of an animal found in this habitat to that of a human. What are the similarities and differences?
- What types of coverings do the animals have on their bodies?

Materials

- Activity Sheet 4: What I Want to Find out about My Habitat, *Atlantic Canada Science Curriculum: Grade 4*, pages 122–123
- clipboards
- gloves
- hand lenses
- insect net
- Intel Play microscope
- plastic bag

Procedure

Prepare for a focused field trip to a local water habitat (e.g., pond, lake, stream, river, marsh) within your community. While at the habitat, have students collect samples of plants and animals that are no longer living. In the classroom, have students examine the specimens using the Intel Play microscope. Research and illustrate a healthy animal living in this habitat, and record the data on Activity Sheet 4: What I Want to Find out about My Habitat, *Atlantic Canada Science Curriculum: Grade 4*, pages 122–123.

Examine the skin on students' hands by using a hand lens or microscope. Compare our skin to that of several of the animals found on the field trip.

Outcomes

Students will be expected to

Science 4

identify their own and their families' impact on habitats and describe how personal actions help conserve habitats (108-3, 108-6)

identify questions to investigate the types of plants and/or animals at a local habitat using the terms **habitat**, **population**, and **community** (104-6, 204-1)

examine and investigate, using various methods and questions, local habitats and their associated populations of plants and animals (204-6, 302-1)

Science 5

describe the role played by body systems in helping humans and other animals to grow and reproduce and to meet their basic needs (302-4)

describe nutritional and other requirements for maintaining a healthy body and evaluate the usefulness of different information sources in answering questions about health and diet (206-4, 302-9)

propose questions to investigate how our body works and what its components are, and relate bodily changes, to growth and development (204-1, 301-8)

describe the body's defences against infections and describe the role of the skin (302-7, 302-8)

Exoskeletons

Outcomes

Students will be expected to

Science 4

compare the external features, behavioural patterns, structural, and/or behavioural adaptations for an animal to survive a particular habitat, real or imagined (204-3, 300-1, 300-2, 302-2)

Science 5

demonstrate how the skeletal, muscular, and nervous systems work together to produce movement (302-6)

Questions

- What exoskeletons can we find in our habitat in autumn?
- What predictions can we make about how the animal died?
- Why do we find insects/arachnids in the house once autumn weather begins?
- How can we demonstrate how these animals move when they are alive?

Materials

- black paint
- hand lenses
- Intel Play microscope
- paintbrushes
- plastic bag
- white paper
- white wax crayons

Procedure

Prepare for a focused field trip to find and collect various exoskeletons. Have students examine the samples using hand lenses and the Intel Play microscope. Using these, as well as books on skeletons and exoskeletons, students will illustrate one animal skeleton by drawing on white paper using a white wax crayon, mixing black paint with water, and washing it over the entire sheet using a paintbrush. The finished result will resemble an X-ray.

Invite students to mime the movements of an animal.

Create a Habitat

Questions

- How can we build a model of a habitat that includes the animals and their needs for survival (e.g., food, shelter)?
- What do animals need to survive a healthy life?
- What do humans need in their environment to lead a healthy life?

Materials

- large fan (the square model works well)
- roll of thin vapour barrier
- roll of duct tape
- various art and recycling supplies

Procedure

Challenge students to create a habitat inside a plastic dome. This can be done comfortably at the end of a hallway or in the gym or multi-purpose room. Measure lengths of vapour barrier (large enough to create a dome that the entire class and teacher can enter). Unfold the strips and tape them together. Allow students to have input as to the best way to tape the plastic to the floor, how to use the fan to create the dome shape, and what size they think the dome will be. The plastic needs to be taped securely to the floor without leaving gaps for the air to escape. It also needs to be secured around the fan. An opening at the opposite end of the fan should be left for entering. Once the fan is turned on, the plastic should rise. It should be tall enough for all to stand. Students can decorate the habitat by taping up light-weight pictures of environmental plants or animals. Included should be food (food chain), shelter, etc. Invite others to visit.

Using the Venn diagram model, compare the needs of an animal to those of humans.

Outcomes

Students will be expected to

Science 4

construct and/or maintain a model of a natural habitat and, through observations, suggest improvements to make it more habitable for organisms (205-5, 205-10, 206-6)

Science 5

describe nutritional and other requirements for maintaining a healthy body and evaluate the usefulness of different information sources in answering questions about health and diet (206-4, 302-9)

Who is Stronger?

Outcomes

Students will be expected to

Science 4

classify organisms and draw diagrams to illustrate their role in a food chain (206-1, 302-3)

predict how the removal of a plant or animal population affects the rest of the community and relate habitat loss to the endangerment or extinction of plants and animals (301-1, 301-2)

Science 5

describe examples of medical techniques and technologies developed by Canadian and other cultures that have contributed to the knowledge of body organisms, systems, and health issues (106-2, 106-4, 107-12, 107-14)

Questions

- Who has the greatest effect on a food chain? Would it be bees or bears?
- What would happen if all of the bees died?

Materials

- search the Internet for the legend about How Bees Got Their Stingers

Procedure

Read the legend about How Bees Got Their Stingers. Discuss the concerns of Canadian beekeepers (in Saskatchewan, Alberta, Nova Scotia, and New Brunswick) who have been complaining that the poison sprays used to kill insects are killing the bees. Foster an awareness of the interrelationship of all life forms (e.g., bees pollinating fruit trees). Discuss the impact on animals and humans in the future if this continues.

Extension Activity

Have students dramatize the legend and present it for another class. Conclude with a discussion and opinion sharing about which animal the audience thought was stronger.

What Our Skeletons Do

Question

- How can we demonstrate what skeletons do for us?

Materials

- modelling clay (to adhere the model to the base)
- packing foam pieces
- pliable wire
- reference books
- sturdy platform (e.g., cardboard, wood)

Procedure

Have students use pliable wire (used by a florist) to build a model of an animal or human skeleton, showing movement. One option is to thread white packing-foam pieces onto the wire to represent bones.

Create a future habitat for the model.

Outcomes

Students will be expected to

Science 4

compare the external features, behavioural patterns, structural, and/or behavioural adaptations for an animal to survive a particular habitat, real or imagined (204-3, 300-1, 300-2, 302-2)

Science 5

select and use tools in building models of organs or body systems (205-2)

propose questions to investigate how our body works, and what its components are, and relate bodily changes to growth and development (204-1, 301-8)

Filtering Systems

Outcomes

Students will be expected to

Science 4

describe how scientists' knowledge of plant growth has led to agricultural and technological innovations and the impact on local and regional habitat issues (105-1, 106-4, 108-1)

Science 5

describe the structure and function of the major organs of the digestive, excretory, respiratory, and circulatory systems (302-5)

describe the body's defences against infections and describe the role of the skin (302-7, 302-8)

Questions

- What is filtering?
- How does the skin protect us from infectious diseases?
- What is the function of the kidneys?
- How does polluted water affect a habitat?

Materials

- clear plastic cups
- large container
- latex gloves
- masking tape
- paper towel
- water mixed with clean sand and rocks

Procedure

The teacher may demonstrate how a filter works. The students may do this also. Tape a double sheet of paper towel over the top of a clear plastic cup, leaving a small "dip" in the top. Mix water, clean sand, and small rocks in a large container. Experiment with filtering systems. Discuss the difference in the water before and after the filtering took place. The students should recognize that we all need clean water to survive.

Kidneys are a filtering system for our body. Demonstrate their usefulness through discussion and diagrams.

Teacher Note: Discuss with students the reason for wearing protective gloves when handling soil. We need to be aware of the germs found in random soil samples. Students need to wear gloves to protect their skin. This is why we suggest using clean sand.

ACTIVITY 37

How Do Our Eyes Work?

Questions

- How do our eyes work?
- Do human eyes work the same as animals' eyes?
- How have adaptations helped animals to survive in their habitats?
- Do all animals have the same capacity for sight?
- What medical techniques and technologies have been developed to improve our vision?

Materials

- computers
- eyedroppers
- newspapers
- poster of the human eye
- reference books
- small container
- water
- waxed paper

Procedure

Invite students to do the following: Place some waxed paper over the newspaper. Look at the print on the newspaper. Fill a container with water. Use the eyedropper to place a drop of water on top of some letters. Look at the print now. What has changed? Try changing the size of the water droplet. Does this affect the size of the print?

Have students research the eyesight of a variety of animals from different habitats including hawks, bats, snakes, moles, etc. Students should graph the results of animals' eyesight distances and make a comparison chart of how animals find food.

Outcomes

Students will be expected to

Science 4

compare the external features, behavioural patterns, structural, and/or behavioural adaptations for an animal to survive a particular habitat, real or imagined (204-3, 300-1, 300-2, 302-2)

Science 5

describe the role played by body systems in helping humans and other animals to grow and reproduce and to meet their basic needs (302-4)

describe examples of medical techniques and technologies developed by Canadians and other cultures that have contributed to the knowledge of body organisms, systems, and health issues (106-2, 106-4, 107-12, 107-14)

Year 2: Sample Plan

Four Components for a Science 4 and Science 5 Combined Class

Weather (All Year)	Addresses outcomes in Science 5: Weather Mathematics 4: Connections Mathematics 5: Connections
Body Systems (All Year)	Addresses outcomes in Science 5: Meeting Basic Needs and Maintaining a Healthy Body Health Education 4 Health Education 5
The World We Live In	Addresses outcomes in Science 4: Habitats Science 4: Rocks, Minerals, and Erosion Science 5: Properties of and Changes in Materials Social Studies 4: The Nature of Exploration, Exploring Our World, and Exploring the Landscapes of Canada
Machines on the Move	Addresses outcomes in Science 4: Light Science 4: Sound Science 5: Forces and Simple Machines Social Studies 5: Place and Environment; Social Structure

Component 1: Weather (All Year)

Weather is addressed continually throughout the year.

Focus and Context

This unit focuses on scientific inquiry. Students should collect data, make predictions, and construct weather instruments. This weather unit connects with Measurement and Data Management and Probability in Mathematics 4 and 5.

Questions/Activities

- Which month had the most rain?
- Design and use a rain gauge to record data.
- Examine weather systems. How do severe weather systems affect habitats?
- What is weather folklore? Which examples are of Nova Scotia Mi'kmaw origin?
- Record sunny, cloudy, and rainy days. Make graphs to record the data for each month. In June discuss and compare the results.
- Observe and record birds seen in your backyard. Which birds are most commonly seen? Which birds are most commonly seen in the fall? the winter? the spring? Record the data on a chart.
- Examine climate changes in our world. Examine global changes in our world.
- Measure the snowfall amounts throughout each month. Check the local weather forecast. Chart/graph the snowfall accumulation throughout the year.
- Global warming is a topic we hear about daily. What examples of weather phenomena are currently being studied? What are the key features of weather systems?

Outcomes

Students will be expected to

Science 5

Weather

identify and use weather-related folklore to predict weather (105-2)

identify examples of weather phenomena that are currently being studied (105-1)

describe how studies of the depletion of the ozone layer, global warming, and the increase in acid rain have led to new innovations and stricter regulations on emissions from cars, factories, and other polluting technologies (106-4)

identify, classify, and compare clouds (104-4, 206-1)

using correct names of weather instruments, construct and use instruments to record temperature, wind speed, wind direction, and precipitation (104-7, 204-8, 205-4, 205-10, 205-7, 300-13)

relate the transfer of energy from the sun to weather and discuss the sun's impact on soil and water (206-5, 303-21)

using a variety of sources, gather information to describe the key features of weather systems and identify weather-related technological innovations and products that have been developed by cultures in response to weather conditions (107-14, 205-8, 302-11)

describe situations demonstrating that air takes up space, has mass, and expands when heated (300-14)

relate the constant circulation of water on Earth to processes of evaporation, condensation, and precipitation (301-13)

- What innovations and regulations on emissions from cars, factories, and other polluting technologies have emerged from studies of the depletion of the ozone layer, global warming, and the increase of acid rain?
- What are the differences and similarities between the cloud types? Identify the various types.
- What weather instruments are used to record temperature, wind speed, wind direction, precipitation, and cloud cover?
- Construct and use instruments to record temperature, wind speed, wind direction, and precipitation. Display the data.
- How does the transfer of energy from the sun relate to weather?
- What is the sun's impact on soil and water?
- What technological innovations and products have been developed in response to weather conditions?
- How can we show that air takes up space? Has mass? Expands when heated?
- Demonstrate the circulation of water on the Earth and the processes of evaporation, condensation, and precipitation.

Component 2: Body Systems (All Year)

This science unit should focus on scientific inquiry. The context is the body systems, individually and as a whole.

Each group or each student will be assigned one body system. Models of the systems will be displayed and discussed.

Focus and Context

This unit focuses on scientific inquiry. Models, diagrams, and information are compiled separately for each body system. As a class, the systems are discussed together to give an overview of the whole body.

Questions/Activities

- How can you keep your body system healthy?
- How is the growth and development of your body related to your body system?
- What is the role of your body system?
- What are the major organs in your body system?
- What medical techniques and technologies, from Canada and other cultures, help your body system?
- How do infections affect your body system?
- Design, build, and label a model of your body system, showing its parts. Present it to the class.
- Discuss, as a class, how all of the body systems interact with one another.
- What new information did you discover?
- What technological devices and materials improve your body system?
- What resources, human and non-human, allow your body systems to work as one unit?

Outcomes

Students will be expected to

Science 5

Meeting Basic Needs and Maintaining a Healthy Body

describe examples of medical techniques and technologies developed by Canadians and other cultures that have contributed to the knowledge of body organisms, systems, and health issues (106-2, 106-4, 107-12, 107-14)

propose questions to investigate how our body works, and what its components are, and relate bodily changes to growth and development (204-1, 301-8)

propose questions and carry out procedures to investigate the factors affecting breathing and heartbeat rate, and compile and display data from these investigations in a graph (205-1, 206-2)

select and use tools in building models of organs or body systems (205-2)

describe nutritional and other requirements for maintaining a healthy body and evaluate the usefulness of different information sources in answering questions about health and diet (206-4, 302-9)

describe the role played by body systems in helping humans and other animals to grow and reproduce and to meet their basic needs (302-4)

describe the structure and function of the major organs of the digestive, excretory, respiratory, and circulatory systems (302-5)

demonstrate how the skeletal, muscular, and nervous systems work together to produce movement (302-6)

describe the body's defences against infections and describe the role of the skin (302-7, 302-8)

Component 3: The World We Live In

This combined-class unit for the year 2 sample plan involves the following units from Science 4 and Science 5:

- Habitats (4)
- Rocks, Minerals, and Erosion (4)
- Properties of and Changes in Materials (5)

All of the outcomes relate to basic overarching questions from a Science, Technology, Society, and the Environment perspective, gradually expanding the focus from local to regional to global.

Focus and Context

The focus of this unit is the environment. Activities are based on scientific inquiry and problem solving. The context is our world (locally, regionally, and globally) and habitats. Relationships with the land and changes in materials will be examined and explored. Elaborations on and evaluations of the students' project information will be discussed. Possible solutions will be presented. Students, individually, will study one animal or plant habitat, preferably local. Then the students may, in groups, look at different habitats and the connections that are in those areas. As a class, students and teachers should look at the relationships locally, regionally, and globally. From various group presentations, common features and differences should be noted. A Venn diagram may help.

Questions/Activities

- What is necessary for a habitat?
- What is found in your habitat?
- What do plants/animals need to survive in their habitat?
- What supports life in your habitat?
- What happens to habitats in various parts of the world?
- Who changes habitats?

Outcomes

Students will be expected to

Science 4

Habitats

identify their own and their families' impact on habitats and describe how personal actions help conserve habitats (108-3, 108-6)

describe how scientists' knowledge of plant growth has led to agricultural and technological innovations and the impact on local and regional habitat issues (105-1, 106-4, 108-1)

identify questions to investigate the types of plants and/or animals at a local habitat using the terms habitat, population, and community (104-6, 204-1)

construct and/or maintain a model of a natural habitat and, through observations, suggest improvements to make it more habitable for organisms (205-5, 205-10, 206-6)

examine and investigate, using various methods and questions, local habitats and their associated populations of plants and animals (204-6, 302-1)

compare the external features, behavioural patterns, structural, and/or behavioural adaptations for an animal to survive a particular habitat, real or imagined (204-3, 300-1, 300-2, 302-2)

classify organisms and draw diagrams to illustrate their role in a food chain (206-1, 302-3)

predict how the removal of a plant or animal population affects the rest of the community and relate habitat loss to the endangerment or extinction of plants and animals (301-1, 301-2)

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Rocks, Minerals, and Erosion

demonstrate respect for the local environment (108-3)

demonstrate and record a variety of methods of weathering and erosion, including human impact on the landscape (301-6, 108-6)

investigate rocks and minerals and record questions and observations (204-1, 205-7)

classify rocks and minerals by creating a chart or diagram that illustrates the classification scheme and compare results with others (104-4, 206-1, 207-2)

explore physical properties of local rocks and minerals, using appropriate tools to collect and compare with those from other places (204-8, 205-5, 300-5, 300-6)

identify and describe rocks that contain records of Earth's history (300-7)

relate characteristics of rocks and minerals to their uses (300-8)

describe ways in which soil is formed from rocks and demonstrate and describe the effects of wind, water, and ice on the landscape (301-4, 301-5)

describe natural phenomena that cause rapid and significant changes to the landscape (301-7)

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- Give examples of how habitats are harmed.
- Name habitats that are developing.
- Make or maintain a model of a habitat.
- What are some ways in which habitats change?
- How can you improve your local habitat?
- What happens to habitats in different seasons?
- What is a population? A community?
- How does erosion affect your habitat?
- Draw a picture of your habitat.
- What does climate change mean in terms of your habitat?
- Investigate a substance in your habitat. What do you observe? Can it change? Is it reversible?
- Is there water in your habitat? Does it change? How?
- What happens when heat is added to a habitat?
- What happens when heat is removed from a habitat?
- What gases are in your habitat? Where do they come from?
- What technological innovations have developed from an impact on local/regional habitat issues?
- Identify some chemical changes that happen in your habitat.
- Where does the energy for your habitat come from?
- Identify the rocks and minerals in your habitat. Show these on a chart. Compare your results with those of others.
- How old is your habitat?
- How do rocks help us learn about ancient societies?
- What types of rocks, minerals, and materials are used for structures in your habitat?
- Describe the effects of weather (wind, water, and ice) on the landscape of your habitat.
- What parts of the habitat are used for food? What effect does this have on the habitat? What happens if you do not plant on a field?
- In your group, distinguish the materials and properties in your habitat. Make a chart.
- Are there any harmful chemicals in your habitat? What are they?

- From your habitat, choose some rocks and soil. Find the mass of each separately. Combine them with water (find its mass) and find the total mass.
- What new information did you discover?
- What surprised you the most?
- What resources, human and non-human, help you understand your habitat?
- How will you organize your habitat information?
- What forms of energy are used in your habitat?
- What technological materials/devices help you in your habitat?
- What factors do you need to consider in order to build an ideal habitat for you?

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Science 5

Properties of and Changes in Materials

use a variety of sources and technologies to identify and describe the source of the materials found in an object, changes to the natural materials required to make the object, and how manufactured materials have been developed to improve living conditions (107-8, 205-8, 300-12)

work with team members to develop and carry out a plan to distinguish a material based on its chemical properties and display the results of the data (204-7, 207-3, 206-2, 204-5)

classify materials as solids, liquids, or gases and illustrate this classification in a property chart (206-1, 300-9)

follow a given set of procedures to relate the mass of a whole object to the sum of the masses of its parts and suggest possible explanations for variations in the results (104-5, 205-3, 300-11)

observe and identify changes in an object's appearance, state, and/or reversibility and classify it as a physical change or not (301-9, 205-5, 301-10)

describe and give examples of the interactions among materials, including gases, and discuss their properties (301-11, 301-12)

Component 4: Machines on the Move

This combined-class unit for the year 2 sample plan involves the following units from Science 4 and Science 5:

- Light (4)
- Sound (4)
- Forces and Simple Machines (5)

All of the outcomes focus on machines on the move. This focus on various machines allows for opportunities of using machines that vary in rural, urban, local, and global areas.

Focus and Context

This unit is focused on problem solving and scientific inquiry. The context is machines, from transportation to construction to household use to our lives—machines that improve our living conditions, our habitat, our jobs, and our health.

Questions/Activities

- Do all machines make sound?
- Which machines have developed and improved over time to make household jobs easier?
- In a class discussion show artifacts (e.g., a manual and an electric can opener, an egg beater and an electric mixer, a broom and a vacuum cleaner, a washboard and a picture of a washing machine) and discuss the progress of technology.
- Look at the development of vehicles used for transportation.
- What types of experiments are done using vehicles?
- Design and perform an experiment, using a toy car, a load (e.g., a rock), and Newton's scale, to find the force needed to lift or pull a load. Report your results.
- What situations require the use of machinery to solve a task? Make a list.
- How do these machines make use of sound? of light?

Outcomes

Students will be expected to

Science 4

Light

describe properties of light that have led to the development of optical devices that enhance our ability to observe (106-1, 106-4)

identify women and men in their community who have careers using optics (107-10)

plan an investigation and communicate questions and ideas with others about light emitted from an object, its own or an external source (204-7, 207-1, 303-3)

classify objects as opaque, transparent, or translucent (206-1)

make observations and collect information about the reflective and refractive properties of various materials of different shapes (205-5)

demonstrate that white light can be separated into colours (dispersion) and follow a set of procedures to make and use a colour wheel (104-6, 205-3, 303-7)

compare and describe how light interacts with a variety of optical devices and construct an optical device that performs a specific function (107-1, 205-10, 303-8)

observe, demonstrate, and make conclusions about how light travels and is dispersed from a variety of light sources (206-5, 303-2)

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investigate and predict how light interacts with a variety of objects (including changes in the location, shape, and relative size of a shadow) in order to determine whether the objects cast shadows, allow light to pass, and/or reflect light (303-4, 303-5)

demonstrate and describe how a variety of media can be used to change the direction of light (303-6)

Sound

use decibel in descriptions of sound intensity while investigating the extent of noise pollution and how to reduce it around them, identify devices that produce loud sounds (104-6, 108-1)

identify objects by the sounds they make and describe examples of devices that enhance our abilities to hear and collect sound data (106-1, 107-1, 303-9)

identify examples of current sound research and technology, including Canadian contributions (105-1, 107-12, 205-8)

demonstrate and describe how the pitch and loudness of sounds can be modified; design, construct, and evaluate a device that has the ability to create sounds of variable pitch and loudness (104-1, 205-2, 206-7, 301-3)

relate vibrations to sound production and compare how vibrations travel differently through a variety of materials (303-10, 303-11)

describe and illustrate how the human ear is designed to detect vibrations and compare the range of sound heard by humans to that heard by some animals (300-3, 300-4)

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- What is the purpose and benefit of the sound? of the light?
- How does sound travel? Light travel?
- What is friction? Give examples of it.
- What is the purpose of the chains on the wheels of heavy machinery?
- What is the purpose of the reflective objects on trucks, bikes, jackets, and sneakers? Does the colour make a difference?
- Which colours reflect light better?
- What is white light?
- Design and perform an investigation on some objects to determine which emit their own light and which depend on an external force (e.g., firefly/star, moon/mirror).
- What do certain colours of light indicate in our world?
- What types of glass (opaque, transparent, translucent) are used in windows/machines? What is the purpose of each?
- Where, in machines, are opaque, transparent, and translucent objects used?
- What contact and non-contact forces allow a machine to start? To stop?
- Find machinery sounds. What is the purpose of the sounds?
- Do sounds machines make have to have a purpose? Give examples.
- How do decibels from machinery affect our hearing? Give examples.
- What types of machines help fishermen locate fish?
- How is this related to vibrations?
- What types of machines help biologists find whales?
- What would treasure hunters use to find sunken vessels?
- Perform experiments to compare how vibrations travel differently, using a variety of materials.
- Which Canadians have contributed to or used technology involving sound and light?
- What are their contributions?
- What did Bombardier do with machines, light, and sound?
- How does the human ear and its design help us to detect vibrations and hear ranges of sounds from machines?

- What is the relationship between our hearing and our work environment?
- What is the purpose of the various lights on a machine such as a car?
- What happens when car headlights shine on the painted road lines? Explain.
- What effect does the wind have on a sailboard or wind turbine?
- What effect does speeding have on stopping quickly?
- How does pushing affect one's speed on a swing?
- Design and perform an experiment on a simple machine to show the usefulness of wheels and axles. Report your results.
- How have pulleys and pulley systems improved the evolution of machinery in the workforce?
- Using pulley systems, perform trials and report your results to show how effectively pulleys decrease production/effort.
- Which vehicles rely on light to perform their function? Make a device, (e.g., periscope).
- What new information did you discover?
- What technological advancements did you find interesting? Explain. How has supply and demand increased the use of machines in our world? Predict future machinery to be used in a particular field.

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Science 5

Forces and Simple Machines

describe examples of how simple machines have improved living conditions and identify machines that have been used in the past and that have developed over time (105-5, 107-8, 205-8)

perform experiments to describe the force needed to lift or pull a given load in standard and non-standard units (205-4, 205-5, 205-6)

design a system of machines to solve a task (204-7)

investigate and compare the effect of friction on the movement of objects over a variety of surfaces (204-1, 204-5, 303-15)

use simple machines to identify the effort and load required to move objects (205-2, 206-9, 303-17)

observe, investigate, and describe how forces can act directly (contact) or from a distance (non-contact) to move or hold objects in place (303-12, 303-13)

demonstrate and describe the effect of increasing and decreasing the amount of force applied to an object (303-14)

demonstrate the use of rollers, wheels, and axles in moving objects (303-16)

design a lever for a particular task and differentiate between the positions of the fulcrum, the load, and the effort (303-18, 303-19)

compare and record the force needed to lift and load an object by using a single pulley system with that needed to lift it by using a multiple pulley system and predict the effect of adding another pulley or load-lifting capacity (303-20, 204-3)

Appendices

Appendix A: Outcomes for Science 4 and Science 5

Below, for reference, are the specific curriculum outcomes for Science 4 and Science 5.

Science 4

Life Science: Habitats

Students will be expected to

Habitats and Populations

- identify questions to investigate the types of plants and/or animals at a local habitat using the terms habitat, population, and community (104-6, 204-1)
- examine and investigate, using various methods and questions, local habitats and their associated populations of plants and animals (204-6, 302-1)
- identify their own and their families' impact on habitats and describe how personal actions help conserve habitats (108-3, 108-6)

Collecting Scientific Information Using Models of Natural Habitats

- construct and/or maintain a model of a natural habitat and, through observations, suggest improvements to make it more habitable for organisms (205-5, 205-10, 206-6)

Behavioural and Structural Features of Animals That Enable Them to Survive in Their Habitat

- compare the external features, behavioural patterns, structural, and/or behavioural adaptations for an animal to survive a particular habitat, real or imagined (204-3, 300-1, 300-2, 302-2)

Structural Features of Plants That Enable Them to Survive in Their Habitat

- describe how scientists' knowledge of plant growth has led to agricultural and technological innovations and the impact on local and regional habitat issues (105-1, 106-4, 108-1)

Food Chains

- classify organisms and draw diagrams to illustrate their role in a food chain (206-1, 302-3)
- predict how the removal of a plant or animal population affects the rest of the community and relate habitat loss to the endangerment or extinction of plants and animals (301-1, 301-2)

Physical Science: Light

Students will be expected to

Optical Devices

- describe properties of light that have led to the development of optical devices that enhance our ability to observe (106-1, 106-4)
- compare and describe how light interacts with a variety of optical devices and construct an optical device that performs a specific function (107-1, 205-10, 303-8)
- identify women and men in their community who have careers using optics (107-10)

Sources of Light

- plan an investigation and communicate questions and ideas with others about light emitted from an object, its own or an external source (204-7, 207-1, 303-3)

Light Radiates from a Source

- observe, demonstrate, and make conclusions about how light travels and is dispersed from a variety of light sources (206-5, 303-2)

Objects That Absorb, Transmit, and/or Reflect Light

- investigate and predict how light interacts with a variety of objects (including changes in the location, shape, and relative size of a shadow) in order to determine whether the objects cast shadows, allow light to pass, and/or reflect light (303-4, 303-5)
- classify objects as opaque, transparent, or translucent (206-1)
- make observations and collect information about the reflective and refractive properties of various materials of different shapes (205-5)

Bending Light

- demonstrate and describe how a variety of media can be used to change the direction of light (303-6)

Dispersion of Light

- demonstrate that white light can be separated into colours (dispersion) and follow a set of procedures to make and use a colour wheel (104-6, 205-3, 303-7)

Physical Science: Sound

Students will be expected to

Objects That Make Sounds

- identify objects by the sounds they make and describe examples of devices that enhance our abilities to hear and collect sound data (106-1, 107-1, 303-9)

Sound Vibrations

- relate vibrations to sound production and compare how vibrations travel differently through a variety of materials (303-10, 303-11)

Pitch, Loudness, and Sound Technology

- demonstrate and describe how the pitch and loudness of sounds can be modified; design, construct, and evaluate a device that has the ability to create sounds of variable pitch and loudness (104-1, 205-2, 206-7, 301-3)

The Ear, Hearing Loss, and Noise Pollution

- describe and illustrate how the human ear is designed to detect vibrations and compare the range of sound heard by humans to that heard by some animals (300-3, 300-4)
- use decibel in descriptions of sound intensity while investigating the extent of noise pollution and how to reduce it around them and identify devices that produce loud sounds (104-6, 108-1)
- identify examples of current sound research and technology, including Canadian contributions (105-1, 107-12, 205-8)

Earth and Space Science: Rocks, Minerals, and Erosion

Students will be expected to

Collecting and Comparing Rocks and Minerals

- demonstrate respect for the local environment (108-3)
- investigate rocks and minerals and record questions and observations (204-1, 205-7)

Properties of Rocks and Minerals

- explore physical properties of local rocks and minerals, using appropriate tools to collect and compare with those from other places (204-8, 205-5, 300-5, 300-6)
- classify rocks and minerals by creating a chart or diagram that illustrates the classification scheme and compare results with others (104-4, 206-1, 207-2)

Uses for Rocks and Minerals

- relate characteristics of rocks and minerals to their uses (300-8)

Erosion and Weathering

- describe ways in which soil is formed from rocks and demonstrate and describe the effects of wind, water, and ice on the landscape (301-4, 301-5)

Soil Formation and Composition

- demonstrate and record a variety of methods of weathering and erosion, including human impact on the landscape (301-6, 108-6)

Record in Rocks

- identify and describe rocks that contain records of Earth's history (300-7)

Sudden and Significant Changes in the Land

- describe natural phenomena that cause rapid and significant changes to the landscape (301-7)

Science 5

Earth and Space Science: Weather

Students will be expected to

Measuring and Describing Weather

- identify and use weather-related folklore to predict weather (105-2)
- using correct names of weather instruments, construct and use instruments to record temperature, wind speed, wind direction, and precipitation (104-7, 204-8, 205-4, 205-10, 205-7, 300-13)
- identify, classify, and compare clouds (104-4, 206-1)
- using a variety of sources, gather information to describe the key features of weather systems and identify weather-related technological innovations and products that have been developed by cultures in response to weather conditions (107-14, 205-8, 302-11)

Sun's Energy Reaching the Earth

- relate the transfer of energy from the sun to weather and discuss the sun's impact on soil and water (206-5, 303-21)

Properties of Air

- describe situations demonstrating that air takes up space, has mass, and expands when heated (300-14)

Movement of Air and Water

- relate the constant circulation of water on Earth to processes of evaporation, condensation, and precipitation (301-13)

Environmental Issues

- identify examples of weather phenomena that are currently being studied (105-1)
- describe how studies of the depletion of the ozone layer, global warming, and the increase in acid rain have led to new innovations and stricter regulations on emissions from cars, factories, and other polluting technologies (106-4)

Physical Science: Forces and Simple Machines

Students will be expected to

Forces and Their Effects

- observe, investigate, and describe how forces can act directly (contact) or from a distance (non-contact) to move or hold objects in place (303-12, 303-13)
- demonstrate and describe the effect of increasing and decreasing the amount of force applied to an object (303-14)
- perform experiments to describe the force needed to lift or pull a given load in standard and non-standard units (205-4, 205-5, 205-6)

Friction

- investigate and compare the effect of friction on the movement of objects over a variety of surfaces (204-1, 204-5, 303-15)
- demonstrate the use of rollers, wheels, and axles in moving objects (303-16)

Simple Machines: An Introduction

- use simple machines to identify the effort and load required to move objects (205-2, 206-9, 303-17)

Simple Machines: Levers

- design a lever for a particular task and differentiate between the positions of the fulcrum, the load, and the effort (303-18, 303-19)

Simple Machines: Pulleys, Systems of Machines

- compare and record the force needed to lift and load an object by using a single pulley system with that needed to lift it by using a multiple pulley system and predict the effect of adding another pulley or load-lifting capacity (303-20, 204-3)
- design a system of machines to solve a task (204-7)
- describe examples of how simple machines have improved living conditions and identify machines that have been used in the past and that have developed over time (105-5, 107-8, 205-8)

Life Science: Meeting Basic Needs and Maintaining a Healthy Body

Students will be expected to

Growth and Development

- propose questions to investigate how our body works, and what its components are, and relate bodily changes to growth and development (204-1, 301-8)
- describe the role played by body systems in helping humans and other animals to grow and reproduce and to meet their basic needs (302-4)

The Systems: Digestive, Excretory, Respiratory, and Circulatory

- describe the structure and function of the major organs of the digestive, excretory, respiratory, and circulatory systems (302-5)
- propose questions and carry out procedures to investigate the factors affecting breathing and heartbeat rate, and compile and display data from these investigations in a graph (205-1, 206-2)

Skeletal, Muscular, and Nervous Systems

- demonstrate how the skeletal, muscular, and nervous systems work together to produce movement (302-6)

Body Systems

- select and use tools in building models of organs or body systems (205-2)

Maintaining a Healthy Body

- describe the body's defences against infections and describe the role of the skin (302-7, 302-8)
- describe nutritional and other requirements for maintaining a healthy body and evaluate the usefulness of different information sources in answering questions about health and diet (206-4, 302-9)
- describe examples of medical techniques and technologies developed by Canadians and other cultures that have contributed to the knowledge of body organisms, systems, and health issues (106-2, 106-4, 107-12, 107-14)

Physical Science: Properties of and Changes in Materials

Students will be expected to

Properties of Materials

- classify materials as solids, liquids, or gases and illustrate this classification in a property chart (206-1, 300-9)

Physical Changes

- observe and identify changes in an object's appearance, state, and/or reversibility and classify it as a physical change or not (301-9, 205-5, 301-10)

Chemical Changes

- describe and give examples of the interactions among materials, including gases, and discuss their properties (301-11, 301-12)
- work with team members to develop and carry out a plan to distinguish a material based on its chemical properties and display the results of the data (204-7, 207-3, 206-2, 204-5)

Sources/Masses of Materials in Objects

- follow a given set of procedures to relate the mass of a whole object to the sum of the masses of its parts and suggest possible explanations for variations in the results (104-5, 205-3, 300-11)
- use a variety of sources and technologies to identify and describe the source of the materials found in an object, changes to the natural materials required to make the object, and how manufactured materials have been developed to improve living conditions (107-8, 205-8, 300-12)

Appendix B: Questioning and Recording

Questioning

Questioning is important. Teachers should use operational questions that allow students to continue to explain and support their observations and inferences. Some questions might be

- What questions do you have?
- What do you see?
- What is happening?
- What happened?
- What did you know about the problem before you began your study?
- What sense did you use to make that observation?
- That is an interesting inference. What observation(s) did you use to support your inference?
- What observation(s) did you make that allow you to say that?
- What evidence do you have for saying _____?
- What evidence do you have to support your inference?
- Have you considered all the evidence?
- What further information do you need?
- What new ideas did you discover?

Examples of effective questions:

Critical Thinking Give reasons for … Describe the steps. Show how this … Explain why … What steps were taken to …? Evaluate the result of … How do you know that …?	**Cause-and-effect relationship** What are the causes of …? What connection exists between …? What are the results of …? If we change this, then …? If these statements are true, then what do you think is most likely to happen?
Comparison What is the difference …? Compare the … How similar are …? How do they go together?	**Problems** What else could you try? Can you find a way to …? Can you figure out how to …?
Data How many …? How often …? How long …? How much …?	**Focus** Have you seen …? What have you noticed about …? How does it feel, smell, look …?
Personalized Which would you rather be like …? What would you think …? How would your answer compare …? What did you try? How do you feel about …? What would you do if …? If you don't know … how could you find out? What is your reason for …?	**Descriptive** Describe … Tell … State … Illustrate … Draw (sketch) … Define … Analyze …
Action What happens if …? What would happen if …? What if …?	

Private/Public Science

Private science is the writer's own notes, diagrams, models, charts, and information for their own use. Public science is the writer's information for "the public" to see. This includes assignments, posters, models, and so on that the writer is allowing others to view.

Writing in science is a very important way to help students clarify their thinking. Have students write explanations, justifications, and descriptions. Here are some writing prompts for journals or logs:

- I think this is so because …
- Write an explanation for a student in a lower grade or for a student who was absent when this was taught.
- What do I understand? What don't I understand?
- I got stuck today because …
- Summarize concepts by drawing pictures of things that do and do not represent the concept.

The best assessment of these student writings would be to respond to them with the intention to develop a written conversation that might lead to clarifying misconceptions and to giving better explanations about the concepts or scientific ideas being developed in the classroom.

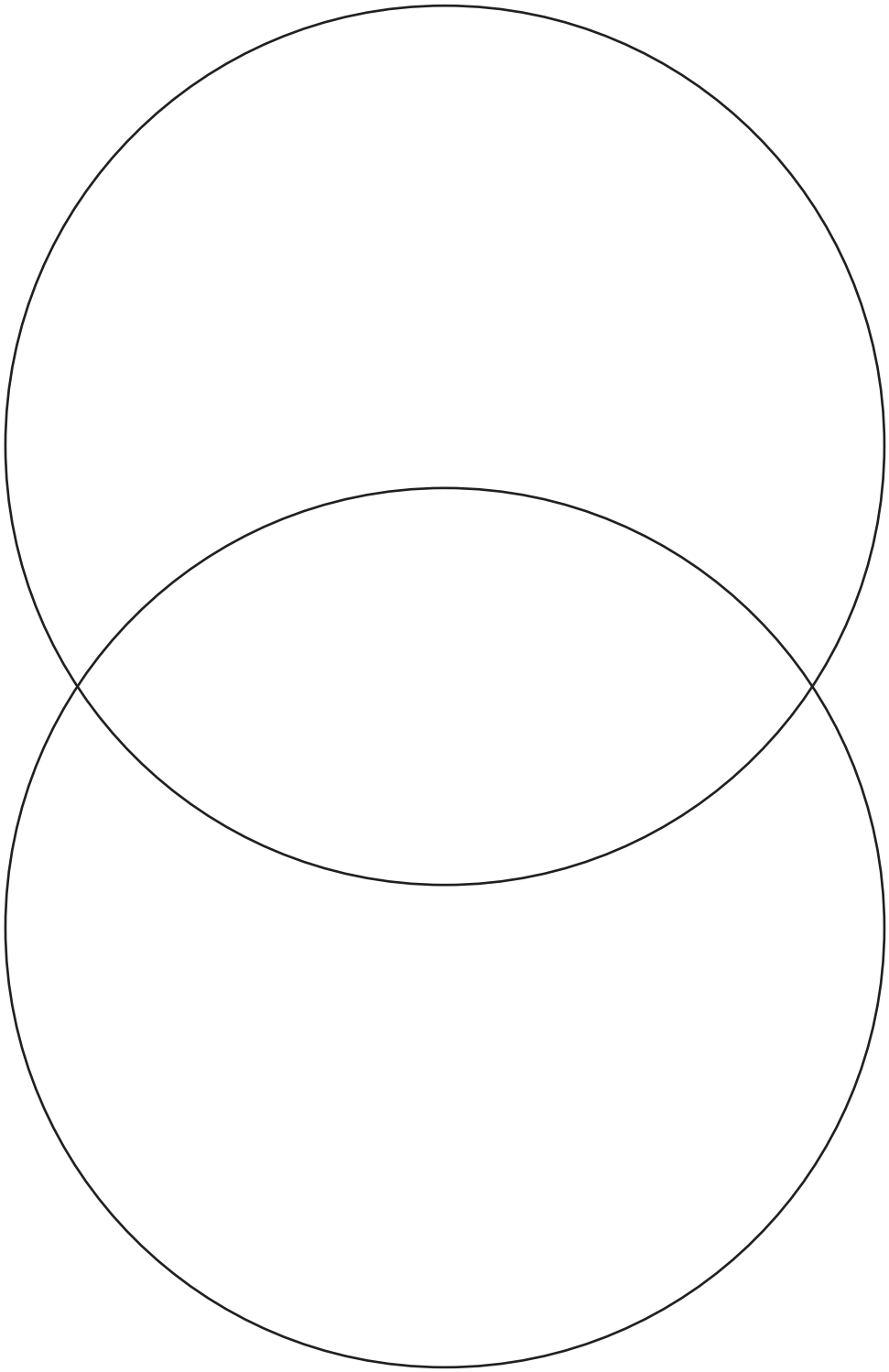
Appendix C: Science Organizers

K-Q-L (Know/Question/Learned)

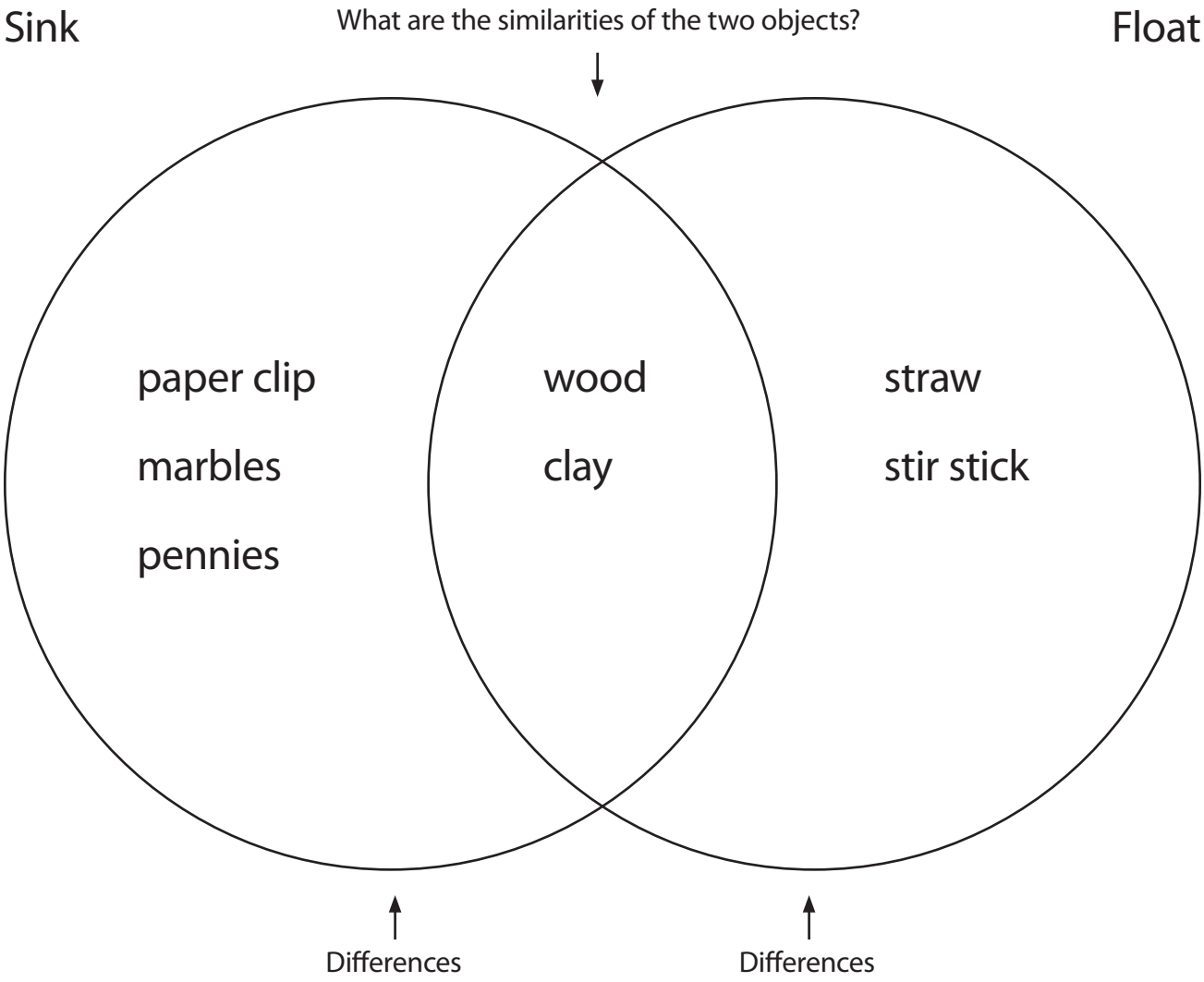
Topic: _____

Know	**Question**	**Learned**
Example: Rocks sink.	Do all rocks sink?	Some rocks sink. Some rocks float.

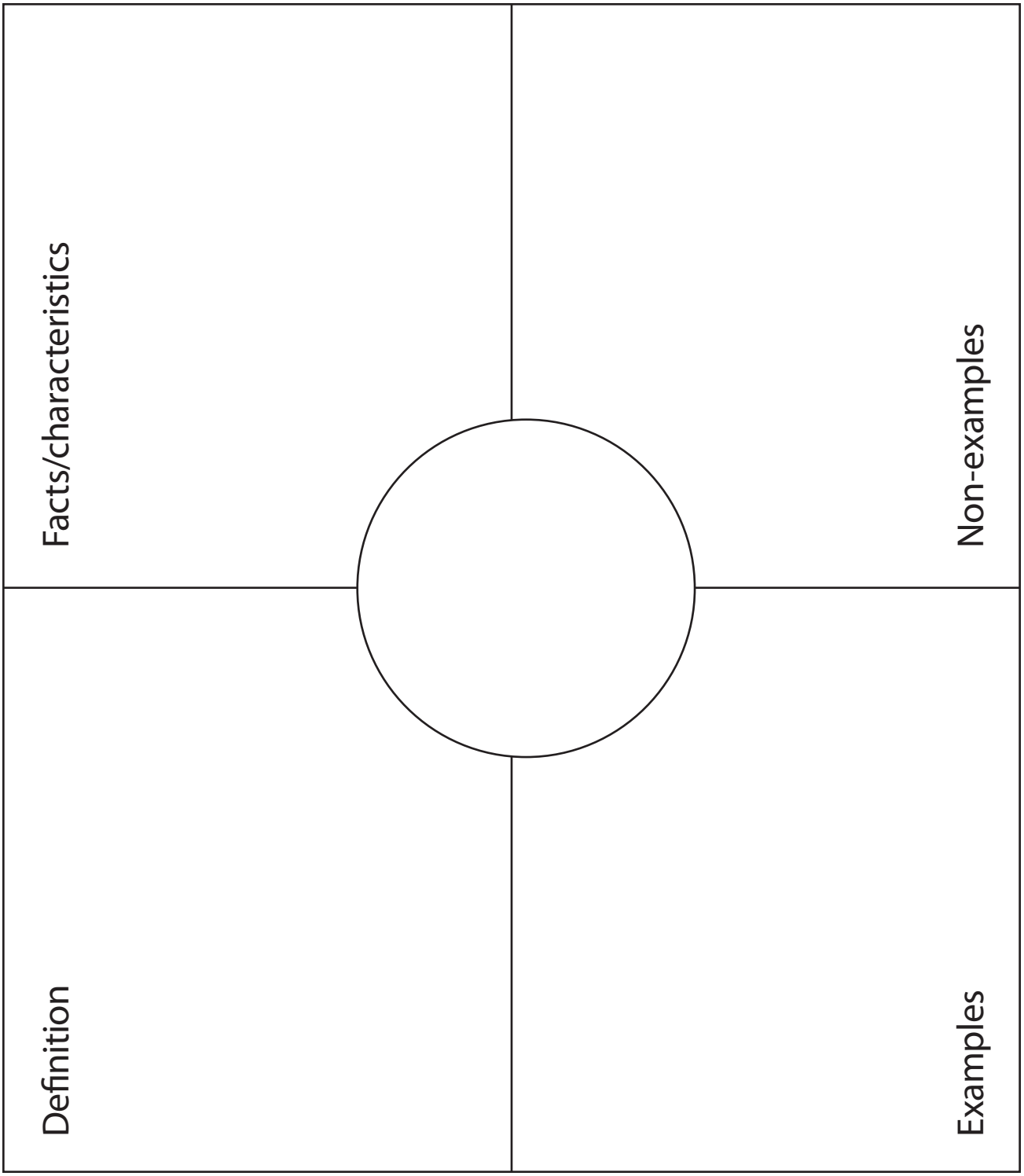
Venn Diagram



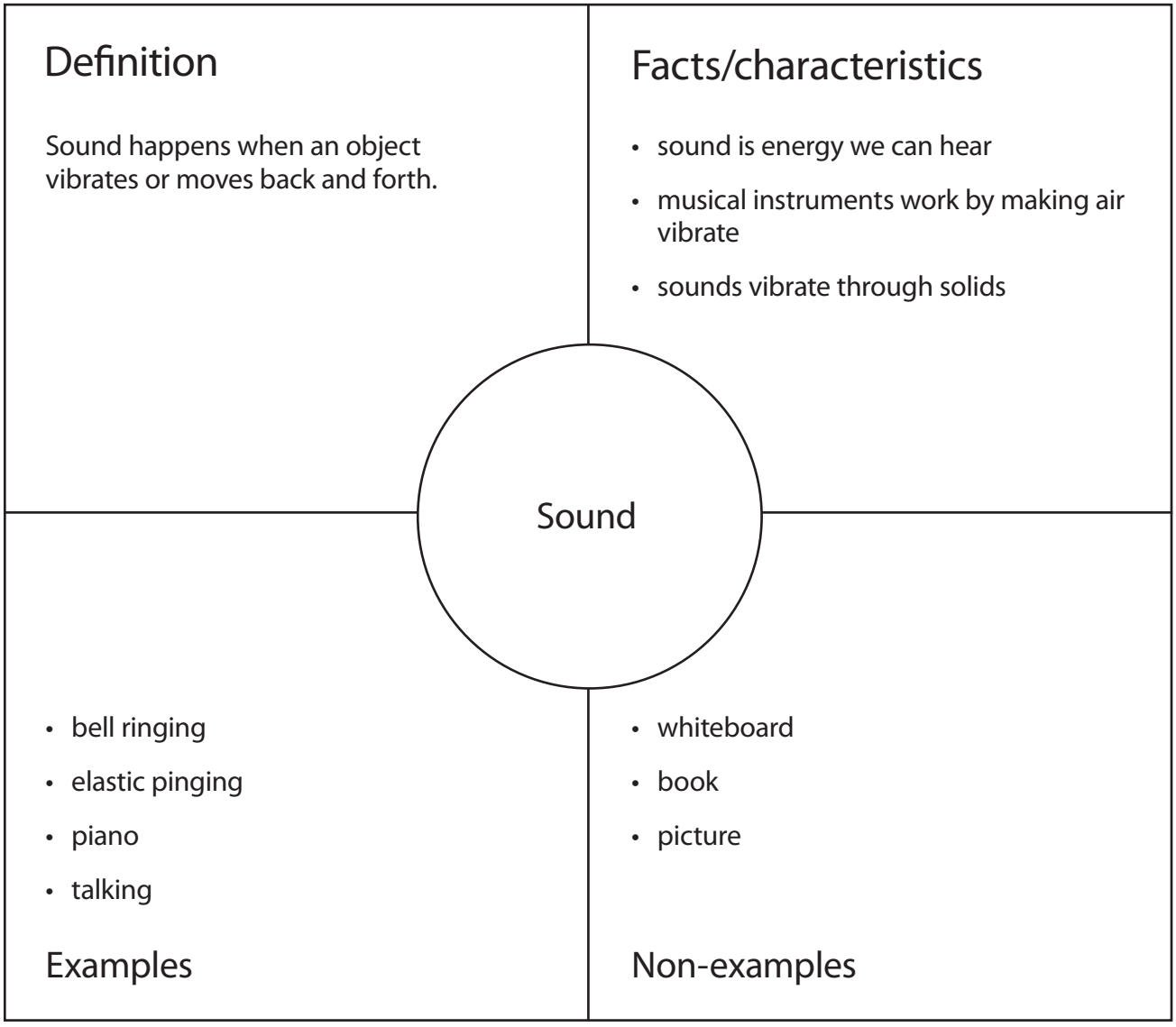
Example of a Venn diagram:



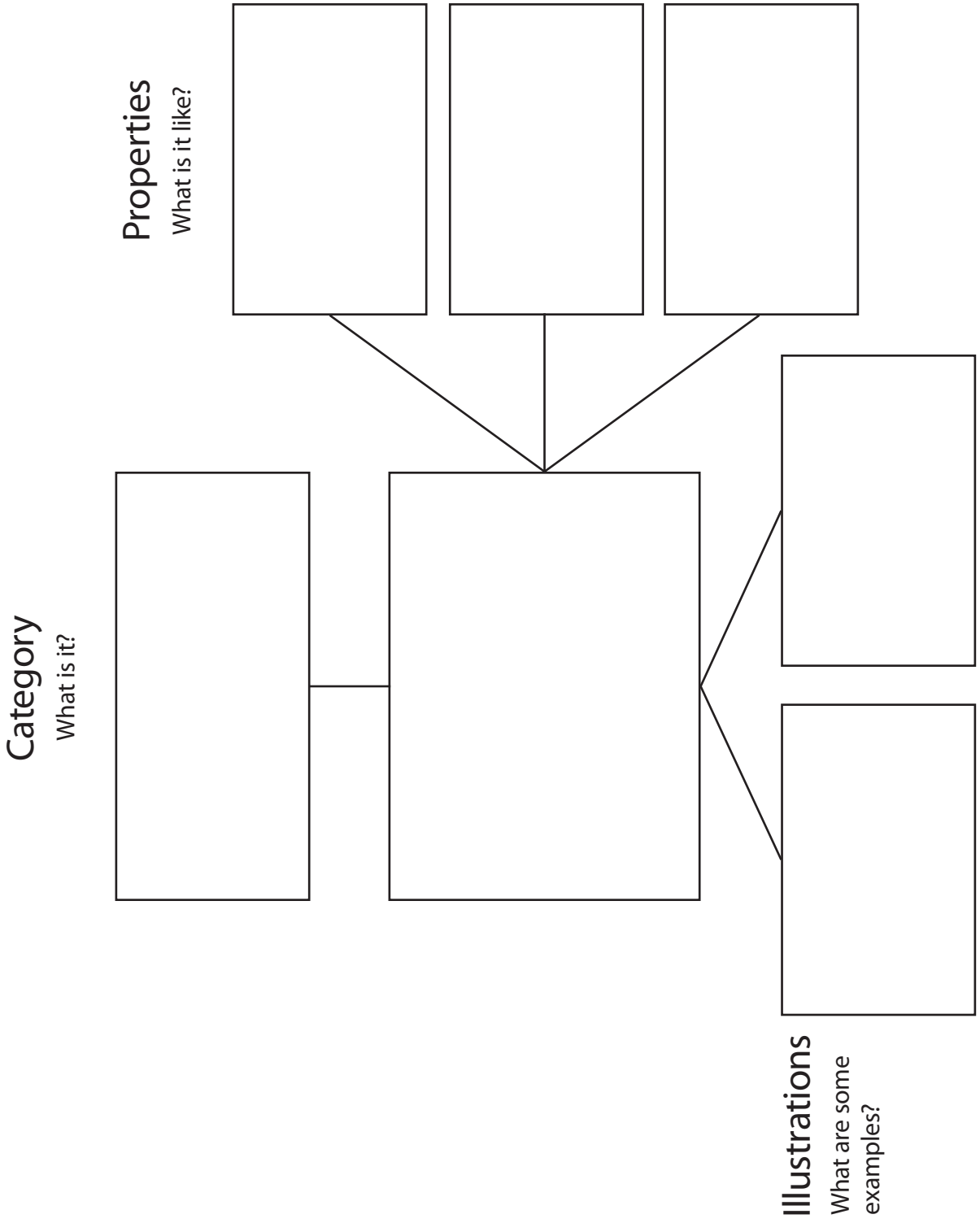
Frayer Model



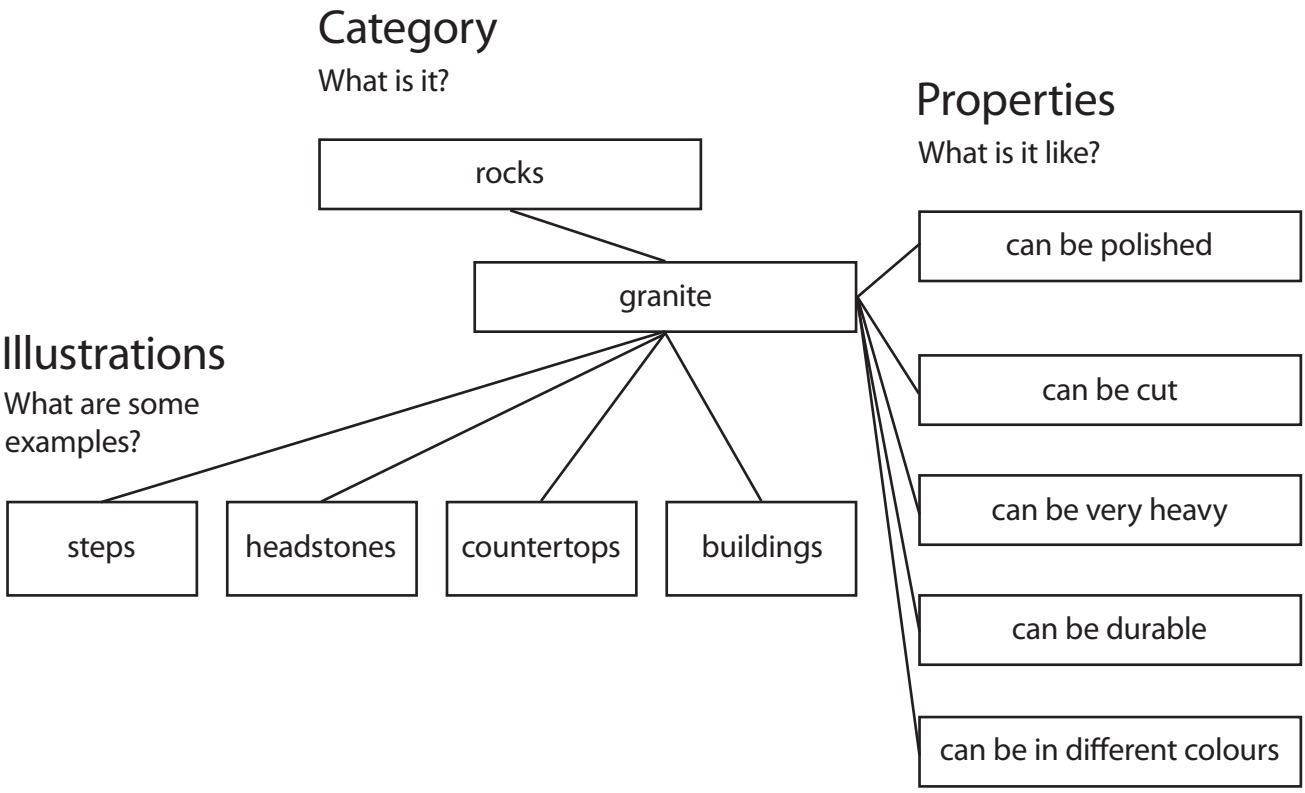
Example of a Frayer Model



Concept Definition Map



Example of a Concept Definition Map



Exit Card

Question:

Answer:

Exit Card

Question:

Answer:

Sample Portfolio Reflection

Name: _____ Date: _____

Type of sample (e.g., the science experiment, observations, the skill practised and learned, results, connections, an overview of the concepts):

_____

is included in my portfolio because

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Teacher Information Chart

We're trying to find out information about _____.

Who can bring …?

artifacts

_____

_____

_____

books

_____

_____

_____

collections

_____

_____

_____

home videos

_____

_____

_____

the ingredients for

_____

_____

_____

magazines

_____

_____

_____

pictures

_____

_____

_____

supplies

_____

_____

_____

tools, instruments

_____

_____

_____

visitors

_____

_____

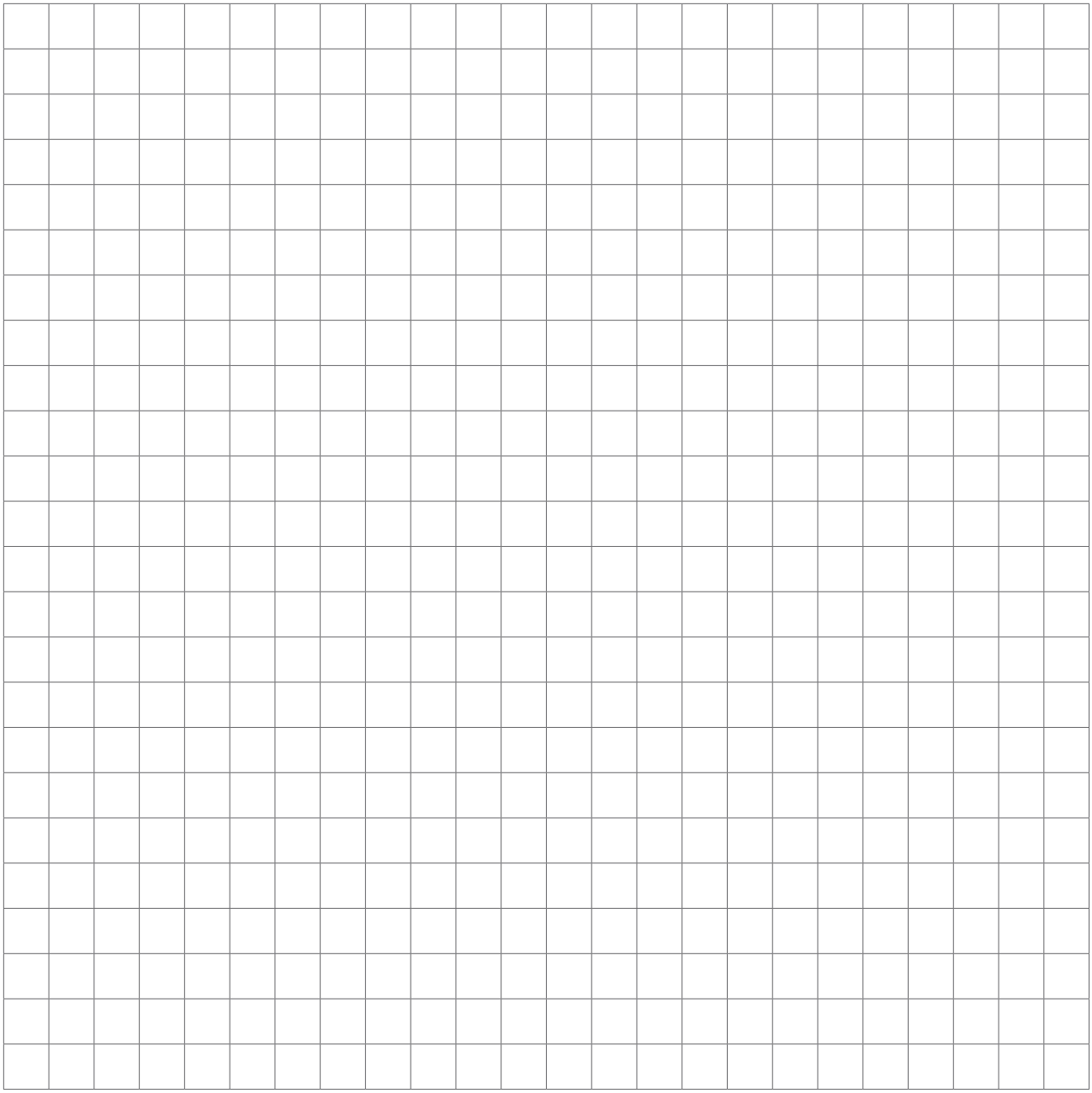
_____

Sample Activity Plan

Outcomes
Focus and Context
Assessment
Question(s)
Materials

Procedure
Curriculum Links
Resources
Enhancements/extensions

Graph Paper



Appendix D: Assessment Tools

Attitude Outcomes

It is expected that the Atlantic Canada science program will foster certain attitudes in students throughout their school years.

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

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

The following two pages present the attitude outcomes from the Pan-Canadian Common Framework of Science Learning Outcomes K to 12 for grades 4–6.

Key-Stage Curriculum Outcomes: Attitudes

From grade 4 through grade 6 students will be expected to

Appreciation of Science	Interest in Science	Scientific Inquiry
409 appreciate the role and contribution of science and technology in their understanding of the world **410** realize that the applications of science and technology can have both intended and unintended effects **411** recognize that women and men of any cultural background can contribute equally to science Evident when students, for example, • recognize that scientific ideas help explain how and why things happen • recognize that science cannot answer all questions • use science inquiry and problem-solving strategies when given a question to answer or a problem to solve • plan their actions to take into account or limit possible negative and unintended effects • are sensitive to the impact their behaviour has on others and the environment when taking part in activities • show respect for people working in science, regardless of their gender, their physical and cultural characteristics, or their views of the world • encourage their peers to pursue science-related activities and interests	**412** show interest and curiosity about objects and events within different environments **413** willingly observe, question, explore, and investigate **414** show interest in the activities of individuals working in scientific and technological fields Evident when students, for example, • attempt to answer their own questions through trial and careful observation • express enjoyment in sharing and discussing with classmates science-related information gathered from books; magazines; newspapers; videos; digital discs; the Internet; or personal discussions with family members, teachers, classmates, and experts • ask questions about what scientists in specific fields do • express enjoyment from reading science books and magazines • willingly express their personal way of viewing the world • demonstrate confidence in their ability to do science • pursue a science-related hobby • involve themselves as amateur scientists in exploration and scientific inquiry, arriving at their own conclusions rather than those of others • ask to use additional science equipment to observe objects in more detail • express the desire to find answers by exploring and conducting simple experiments	**415** consider their own observations and ideas as well as those of others during investigations and before drawing conclusions **416** appreciate the importance of accuracy and honesty **417** demonstrate perseverance and a desire to understand Evident when students, for example, • ask questions to ensure they understand • respond positively to the questions posed by other students • listen attentively to the ideas of other students and consider trying out suggestions other than their own • listen to, recognize, and consider differing opinions • open-mindedly consider non-traditional approaches to science • seek additional information before making a decision • base conclusions on evidence rather than preconceived ideas or hunches • report and record what is observed, not what they think ought to be or what they believe the teacher expects • willingly consider changing actions and opinions when presented with new information or evidence • record accurately what has been seen or measured when collecting evidence • take the time to repeat a measurement or observation for greater precision • ask questions about what would happen in an experiment if one variable were changed • complete tasks undertaken or all steps of an investigation • express the desire to find answers by conducting simple experiments

Key-Stage Curriculum Outcomes: Attitudes

From grade 4 through grade 6 students will be expected to

Collaboration	Stewardship	Safety
418 work collaboratively while exploring and investigating Evident when students, for example, • complete group activities or projects • willingly participate in co-operative problem solving • stay with members of the group during the entire work period • willingly contribute to the group activity or project • willingly work with others, regardless of their age, their gender, or their physical or cultural characteristics • willingly consider other people's views of the world	**419** be sensitive to and develop a sense of responsibility for the welfare of other people, other living things, and the environment Evident when students, for example, • choose to have a positive effect on other people and the world around them • frequently and thoughtfully review the effects and consequences of their actions • demonstrate a willingness to change their behaviour to protect the environment • respect alternative views of the world • consider cause-and-effect relationships that exist in environmental issues • recognize that responding to our wants and needs may negatively affect the environment • choose to contribute to the sustainability of their community through individual positive actions • look beyond the immediate effects of an activity and identify its effects on others and the environment • willingly suggest how we can protect the environment	**420** show concern for their safety and that of others in planning and carrying out activities and in choosing and using materials **421** become aware of potential dangers Evident when students, for example, • look for labels on materials and seek help to interpret them • ensure that all steps of a procedure or all instructions given are followed • repeatedly use safe techniques when transporting materials • seek counsel of the teacher before disposing of any materials • willingly wear proper safety attire, when necessary • recognize their responsibility for problems caused by inadequate attention to safety procedures • stay at their own work area during an activity, to minimize distractions and accidents • immediately advise the teacher of spills, breaks, or unusual occurrences • share in cleaning duties after an activity • seek assistance immediately for any first-aid concerns like cuts, burns, and unusual reactions • keep the work station uncluttered, with only appropriate materials present

Class Observation Sheets

	Names														
Appreciation of Science **409** appreciate the role and contribution of science and technology in their understanding of the world **410** realize that the applications of science and technology can have both intended and unintended effects **411** recognize that women and men of any cultural background can contribute equally to science Evident when students, for example,															
• recognize that scientific ideas help explain how and why things happen															
• recognize that science cannot answer all questions															
• use science inquiry and problem-solving strategies when given a question to answer or a problem to solve															
• plan their actions to take into account or limit possible negative and unintended effects															
• are sensitive to the impact their behaviour has on others and the environment when taking part in activities															
• show respect for people working in science, regardless of their gender, their physical and cultural characteristics, or their views of the world															
• encourage their peers to pursue science-related activities and interests															

	Names														
Interest in Science **412** show interest and curiosity about objects and events within different environments **413** willingly observe, question, explore, and investigate **414** show interest in the activities of individuals working in scientific and technological fields Evident when students, for example,															
• attempt to answer their own questions through trial and careful observation															
• express enjoyment in sharing and discussing with classmates science-related information gathered from books; magazines; newspapers; videos; digital discs; the Internet; or personal discussions with family members, teachers, classmates, and experts															
• ask questions about what scientists in specific fields do															
• express enjoyment from reading science books and magazines															
• willingly express their personal way of viewing the world															
• demonstrate confidence in their ability to do science															
• pursue a science-related hobby															
• involve themselves as amateur scientists in exploration and scientific inquiry, arriving at their own conclusions rather than those of others															
• ask to use additional science equipment to observe objects in more detail															
• express the desire to find answers by exploring and conducting simple experiments															

	Names														
Scientific Inquiry **415** consider their own observations and ideas as well as those of others during investigations and before drawing conclusions **416** appreciate the importance of accuracy and honesty **417** demonstrate perseverance and a desire to understand Evident when students, for example,															
• ask questions to ensure they understand															
• respond positively to the questions posed by other students															
• listen attentively to the ideas of other students and consider trying out suggestions other than their own															
• listen to, recognize, and consider differing opinions															
• open-mindedly consider non-traditional approaches to science															
• seek additional information before making a decision															
• base conclusions on evidence rather than preconceived ideas or hunches															
• report and record what is observed, not what they think ought to be or what they believe the teacher expects															
• willingly consider changing actions and opinions when presented with new information or evidence															
• record accurately what has been seen or measured when collecting evidence															

	Names														
Scientific Inquiry **415** consider their own observations and ideas as well as those of others during investigations and before drawing conclusions **416** appreciate the importance of accuracy and honesty **417** demonstrate perseverance and a desire to understand Evident when students, for example,															
• take the time to repeat a measurement or observation for greater precision															
• ask questions about what would happen in an experiment if one variable were changed															
• complete tasks undertaken or all steps of an investigation															
• express the desire to find answers by conducting simple experiments															

	Names														
Collaboration **418** work collaboratively while exploring and investigating Evident when students, for example,															
• complete group activities or projects															
• willingly participate in co-operative problem solving															
• stay with members of the group during the entire work period															
• willingly contribute to the group activity or project															
• willingly work with others, regardless of their age, their gender, or their physical or cultural characteristics															
• willingly consider other people's views of the world															

	Names														
Stewardship **419** be sensitive to and develop a sense of responsibility for the welfare of other people, other living things, and the environment Evident when students, for example,															
• choose to have a positive effect on other people and the world around them															
• frequently and thoughtfully review the effects and consequences of their actions															
• demonstrate a willingness to change their behaviour to protect the environment															
• respect alternative views of the world															
• consider cause-and-effect relationships that exist in environmental issues															
• recognize that responding to our wants and needs may negatively affect the environment															
• choose to contribute to the sustainability of their community through individual positive actions															
• look beyond the immediate effects of an activity and identify its effects on others and the environment															
• willingly suggest how we can protect the environment															

	Names														
Safety **420** show concern for their safety and that of others in planning and carrying out activities and in choosing and using materials **421** become aware of potential dangers Evident when students, for example,															
• look for labels on materials and seek help to interpret them															
• ensure that all steps of a procedure or all instructions given are followed															
• repeatedly use safe techniques when transporting materials															
• seek counsel of the teacher before disposing of any materials															
• willingly wear proper safety attire, when necessary															
• recognize their responsibility for problems caused by inadequate attention to safety procedures															
• stay at their own work area during an activity, to minimize distractions and accidents															
• immediately advise the teacher of spills, breaks, or unusual occurrences															
• share in cleaning duties after an activity															
• seek assistance immediately for any first-aid concerns like cuts, burns, and unusual reactions															
• keep the work station uncluttered, with only appropriate materials present															

Three Processes of Science Literacy

Individual Student Sheet

Name:	Date of observations:
Skills of inquiry	
Questioning	
Observing	
Inferring	
Predicting	
Measuring	
Classifying	
Designing experiments	
Collecting data	
Interpreting data	
Problem solving	
Proposing prototypes, products, techniques	
Creating prototypes, products, techniques	
Testing prototypes, products, techniques	
Decision making	
Determining or responding to a particular context, supported by evidence	

Three Processes of Science Literacy

Class Sheet

Date of observations:	Names														
Skills of inquiry															
Questioning															
Observing															
Inferring															
Predicting															
Measuring															
Hypothesizing															
Classifying															
Designing experiments															
Collecting data															
Interpreting data															
Problem solving															
Proposing prototypes, products, techniques															
Creating prototypes, products, techniques															
Testing prototypes, products, techniques															
Decision making															
Determining or responding to a particular context, supported by evidence															

Student Self-evaluation Form

Name: _____ Unit: _____

The activity I enjoyed the most was _____

because _____

_____

_____

My role in helping the group experiment be successful was

_____

_____

_____

My role In group activities was

_____

_____

_____

My role In independent activities was

_____

_____

_____

Appendix E: Resources

Using Software Resources in Science Classrooms

A wide variety of software titles is useful in all classroom areas, including the science classroom. These include word processors, databases, spreadsheets, graphics programs, presentation and/or multimedia production programs, video productions, concept mapping applications, and Internet browsers.

Many aspects of the science curriculum can make use of basic software such as word processing applications. Any written work, either done independently or in groups, can be produced on the computer, if appropriate. Much of this work can be done both at home and in school through the use of storage media or the e-mailing of documents. Data manipulation, using tables and calculations, and the collection of information, both qualitative and quantitative, can be made more efficient and effective through the use of databases and spreadsheets. Data charts can easily be converted into graphs through spreadsheet applications.

Several presentation and multimedia programs are available to schools, either as part of the IEI project or at bulk prices through Nova Scotia Authorized Learning Resources. These programs are excellent for allowing students to present the information collected on a topic, to augment group reports on the work done and research gathered, or for many other activities within the science classroom. Software such as PowerPoint, Microsoft Publisher, and Kid Pix Deluxe enable students to present their knowledge in creative and innovative ways. If students are presenting their knowledge and understanding through skits and dramatic activities, the use of video editing software (iMovie for Apple computers or Pinnacle Studio for Windows computers) can greatly enhance their productions.

Concept mapping software is an excellent resource for collecting the information shared by students in brainstorming activities as well as a quick way for students to display the information collected on topics done in class. Outlining, thought webbing, and other organizers can be created and used through these types of software. One such software program, available in most schools in Nova Scotia, is Inspiration.

Graphics programs can be used to create illustrations, cartoons, and diagrams. These can then be inserted into computerized reports, presentations, concept maps, etc. Very basic images can be created in software such as Paint (in the Accessories on Windows computers). More sophisticated images can be made by using the drawing tools of Microsoft Word, or graphics programs such as Painter, Adobe Illustrator, or PhotoShop.

Specific software programs for different grades and aspects of the science curriculum are currently listed in Nova Scotia Authorized Learning Resources.

Below are suggested software titles that are currently listed. An annotated list of these titles is included at the end of this section.

Grades 4–5 Science Software Titles

- ArcView
- Community Construction Kit
- Decisions, Decisions: The Environment
- Eyewitness Encyclopedia of Nature
- Eyewitness Encyclopedia of Science
- Intel Play QX5 Microscope
- Interactive Bully—Victim: Push and Shove
- Inspiration
- My Amazing Human Body
- Neighborhood MapMachine
- PASCO—DataStudio; Interface box; sensors (all purchased separately)
- Rainforest Researchers
- Science Court: Water Cycle
- The Graph Club
- The New Way Things Work
- TinkerPlots
- Virtual Labs: Light and Virtual Labs: Electricity (bundle)

Technological Tools for Science

"Technology" does not equal "computers." There are many other technological tools that will provide students with excellent learning opportunities in science. Some recommended technological tools that are available and can be used as part of curricular activities are listed below.

A minimum of one per school:

- photocopier (for activities involving congruency and scale)
- video camera
- still camera
- devices to show videos (For a list of videos available through the Nova Scotia Department of Education, see lrt.ednet.ns.ca/media_library/catalogues/science.shtml.)
- computer and computer peripherals such as a scanner, printer, and CD burner

One per classroom:

- overhead projector
- audio recorder/player for tape cassettes and CDs (if possible)

Alphabetical Software List for Science, with Annotations

Title: ArcView
Grade levels: P–12
Nova Scotia School Book Bureau (NSSBB): 51178

ArcView permits students to interpret data, create maps, do presentations, and explore many real geographic information system (GIS) databases. From community studies in elementary grades to advanced problem solving using environmental or original data, many courses can make use of this software to provide experiences previously impossible. It encourages student analysis and critical thinking. Several Nova Scotia municipalities use GIS data, so students may have access to real data for their projects.

Title: Community Construction Kit
Grade levels: 1–5
NSSBB: 51201, 51202

One of the most comprehensive programs available for elementary students, this CD provides constructivist experiences using social studies, art, mathematics, language arts, and science components. Especially useful in curricula dealing with communities, it allows students to deal with the concepts of neighbourhood, shape recognition, and spatial relationships and choose natural resources and building materials to create projects. Descriptive writing, analysis, problem solving, and creativity are all integral parts of the use of this program. There is a United States culture and history component. The interface is simple and motivating yet allows for many experiences. Students can work in specialized cultures from Native American to medieval to the present. They can make personal cutouts of various architectural styles and props of animals, people, etc. This program can be used in a variety of ways, and students can become involved in many issues by using the program as a starting point. Students can be encouraged to develop their own stories or create settings for other stories. The teacher's guide includes many lesson plans, ideas, and extension activities.

Title: Decisions, Decisions: The Environment
Grade levels: 4–12
NSSBB: 51393, 51394

This simulation combines science and social studies as students address crucial environmental-awareness questions. This realistic program teaches students how to solve problems and make decisions, identify priorities, and analyze the consequences of decisions. It encourages students to read and collaborate. The program is interactive and displays the status of the student(s) from start to finish.

Title: Eyewitness Encyclopedia of Nature
Grade levels: 4–9
NSSBB: 50996, 50997

This interactive program leads students through the world of nature to explore the lives and habitats of hundreds of species of animals and plants. It makes use of animation, sound, and video sequences. The latest version has online access as well. It contains a variety of topics and good graphics. It fits in many areas of the curriculum: communities of living things, habitats, environmental studies, dinosaurs, weather, and more. It makes a good resource for projects, background information on many topics, and discussion starters and enrichment.

Title: Eyewitness Encyclopedia of Science
Grade levels: 4–9
NSSBB: 51070, 51071

This program provides a source of general scientific information (mathematics, chemistry, physics, life sciences, and people in science) and an insight into the technical world in which we live. It uses illustrations, animation, audio, and video sequences. Its science dictionary is useful, and the updated version has an improved quiz section. The teacher's manual has useful teaching-activity suggestions and blackline masters. Students should enjoy exploring the program's many science topics, with its ease of navigation, searchability, and quality presentations. A French-language version is also available.

Title: Inspiration
Grade levels: P–12
NSSBB: 51299

Inspiration is a concept mapping program. Concept mapping allows students, teachers, or anyone planning a project, event, or experience to draw organizing diagrams. These can be various geometric shapes or objects with lines connecting as relational, logic, or time paths. Various shapes and styles make this program adaptable to almost any grade level. It encourages open-ended and co-operative learning activities and could be used in any subject area. It supports importing and exporting from other applications and can save to HTML for web pages.

Students can improve writing by easily rearranging ideas and clarifying priorities. Using good software to facilitate this approach to idea development can give creative minds a workable tool that fosters creativity. Concept mapping allows active thinking and enables others (peers or teachers) to quickly understand the status of one's planning. It can be used from the initial brainstorming stages through outlining and project tracking. There are many ways to use this software. It can also be used for problem solving, data collection, presentations, review, and assessment.

Title: Intel Play QX5 Microscope
Grade levels: 4–12
NSSBB: 51333

This software comes with the DigitalBlue (formerly called Intel Play) Computer Microscope. It enables students to capture images, still or moving, of the microscope's view. The images can be manipulated as students add annotations or graphics effects. The images can be placed in slide shows or exported to other documents or the web. It does require a Windows 98 computer with a USB port. It will not work with Macintosh computers.

Title: My Amazing Human Body
Grade levels: P–6
NSSBB: 51317, 51318

This software introduces grades 1–8 students to the human body. It contains interactive games and activities hosted by an enthusiastic skeleton. The program provides detailed information about all aspects of the human body through four main activities: Build Me a Body, Take Me Apart, Me and My Day, and What Am I Made Of? These four activities require limited input from the students but allow them to explore and learn through discovery. The program allows searches and permits personalization in a journal (secret file) activity. There are three levels in the program: A, for grades 1–3; B, for grades 4–6; and C, for grades 7–8. Some sensitive anatomy elements are omitted. The program includes audible and visual prompting and provides positive feedback.

Title: Neighborhood MapMachine
Grade levels: 2–5
NSSBB: 51209, 51210

This is a co-operative-learning, critical-thinking program. Students make personal, real, or imaginary maps. While doing this, they can learn about grids, scale and distance, spatial relationships, land use, communities, town planning, research, the environment, and more. This program encourages problem solving, co-operative information sharing, and the presentation of student work and conclusions. Many activities can be based on the students' maps, from the calculation of shortest distances, to stories, to art. The built-in tools allow the creation of maps, with roads, buildings, trees, etc., and include other tools to record written or oral notes. Pictures and movies can be added from scanners, cameras, etc. A slide show can also be prepared using a series of maps. The Community Construction Kit CD-ROM is an excellent companion resource.

Title: PASCO—DataStudio
Grade levels: 4–12
NSSBB: 51390

Data Studio software is used with probes for data logging, remote data collection and storage, and the acquisition of real-time data as experiments are being carried out. This software is intended to be used with an interface connector and various sensor probes. NOTE: The interface connector and probes must all be purchased separately.

Title: PASCO Interface Connector
(ScienceWorkshop Interface 500 or USB PasPort)
Grade levels: 4–12
Evaluation level: Can be purchased through the NSSBB (51233)

Title: PASCO Data Sensors—motion, temperature, sound, heart rate
Grade levels: 4–12
Evaluation level: Can be purchased through the NSSBB (51229, 51235, 51234, 51228)

Title: Rainforest Researchers
Grade levels: 5–8
NSSBB: 51206, 51207

This complete teaching package, with plans, sets of small reference texts, and CD-ROM, provides an in-depth co-operative-learning experience. Students become members of a research team investigating Indonesian rainforest plants. Provided with an introductory video and expert information, they must solve problems as they learn about the rainforest environment. Steps are well laid out for the teacher and students, and this program takes several learning periods to complete. However, unlike a purely constructivist tool, the whole process would only be used a couple of times with students. Nonetheless, the interesting co-operative-learning experiences are rich. Each student can role-play one of the experts (plant chemist, taxonomist, ethnobiologist, or ecologist) and try to justify her or his answers and then see the results of the decision making. This can become very involving for students as they work online and offline over a period of time on one of the program's two scenarios: one with certain plants not doing

well and the other looking for a plant with promising medicinal potential. The guide's class management plans and details for off-computer experiences are helpful and enriching. Science becomes more real with this excellent program.

Title: Science Court: Water Cycle
Grade levels: 4–9
NSSBB: 51218

In the court case regarding leaky pipes, a meteorologist character takes the stand as an expert witness to determine whether the pipes are really leaky or if they are victims of the water cycle. Students must examine the facts and perform hands-on experiments to help them predict the verdict. The video clips on the water cycle are interesting on their own but take on more significance as students try to reach conclusions.

Title: The Graph Club
Grade levels: P–6
NSSBB: 51403

This program allows students to create and explore graphs. Students learn how to put information together to create graphs and also how to use the information they show. Using audio and printed instructions, students can prepare various types of graphs. The program can be used to develop concepts and as a graphing tool. Data can be generated within the program or entered by students. It is quite interactive and could even serve as a starting point for various discussions. The graphs are dynamic and change as the data is altered. Several different formats for displaying data are available, with the option to change the appearance and range of the data to be displayed. This program would provide a good source of activities for students in lower grades to begin to develop an understanding of the graphical representation of information. This is an excellent resource for both science and mathematics in the elementary grades, with possibilities for use with students with special needs at other levels.

Title: The New Way Things Work
Grade levels: P–6
NSSBB: 50836, 50838

This is an interactive program that uses animation and sound to introduce students to the world of science and technology. Students can see and hear for themselves how machines really work. The new version contains a live-action tour guide and a built-in connection to the mammoth.net web site for young inventors. The program is vast in scope and fun to use. A French-language version is also available.

Title: TinkerPlots
Grade levels: 4–9
NSSBB: 51469, 51470, 51471, 51472

TinkerPlots is a data-management and statistical-analysis tool suitable for students in grades 4 to 9. It can be used in several discipline areas, including mathematics, science, and social studies.

The program provides sample data and activities for students, and allows students to collect their own data and input it for analysis. The program allows varying sorts, displays, and queries for the data. This software provides students with a tool that enables them to ask questions and investigate information in many different ways.

Title: Virtual Labs: Light
Grade levels: Light: 4 and 8
NSSBB: 22821

This program is a virtual light laboratory that allows for exploration into the behaviour of light. Topics included are reflection, refraction, colour mixing (additive and subtractive), and colour splitting. The program provides many ready-to-use experiments with worksheets. The experiments can be modified, and new experiments can be created by teachers or by students. Students can plan and create experiments on the computer before putting them together in real life. Student work can be printed, a snapshot of the completed activity can be saved to disc, and the final lab can be saved completely. The built-in activities are planned to start with simple explorations and end with difficult and challenging work. Some of the activities are suitable for grade 4.

Note: The Virtual Labs titles Virtual Labs: Light and Virtual Labs: Electricity must be purchased as a bundle, with both titles included.

Print Resources

Nova Scotia Department of Education. *Atlantic Canada Science Curriculum: Grade 4*. Halifax, NS: Province of Nova Scotia, 2006.

Nova Scotia Department of Education. *Atlantic Canada Science Curriculum: Grade 5*. Halifax, NS: Province of Nova Scotia, 2008.

Nova Scotia Department of Education. *Science Safety Guidelines: Grades Primary–12*. Halifax, NS: Province of Nova Scotia, 2005.

Nova Scotia Department of Education. *Active Young Readers, Grades 4–6: Assessment Resource*. Halifax, NS: Province of Nova Scotia, 1998.

Nova Scotia Department of Education. *Public School Network Access and Use Policy*. P and I Release, August 20, 2008. Halifax, NS: Province of Nova Scotia, 2008.

Robinson, Sandra Chisolm. *The Rainstick, A Fable*. Guilford, CT: TwoDot, 1994.

Authorized Learning Resources

Please check Authorized Learning Resources at the NSSBB web site, for additional resources to complement activities:
https://edapps.ednet.ns.ca/nssbb/

Science and Technology 5, Atlantic Student Package (18679–80, 18660, 18668, 18687, 18689)

Cube-A-Link Kit (13951)

Videos

Catalogue of videos available through the Nova Scotia Department of Education: lrt.EDnet.ns.ca/media_library/catalogues/science.shtml