SCIENCE STANDARDS OF LEARNING
ENHANCED SCOPE & SEQUENCE

GRADE 1

Commonwealth of Virginia
Department of Education
Richmond, Virginia
2005

Virginia Department of Education
P.O. Box 2120
Richmond, Virginia 23218-2120
http://www.doe.virginia.gov

Superintendent of Public Instruction
Jo Lynne DeMary

Deputy Superintendent for Instruction
Patricia I. Wright

Assistant Superintendent for Instruction
Linda M. Wallinger

Office of Elementary Instructional Services
Linda Poorbaugh, Director
Paula J. Klonowski, Science Specialist

Edited, designed, and produced by the CTE Resource Center
Margaret L. Watson, Administrative Coordinator
Bruce B. Stevens, Writer/Editor
Richmond Medical Park
2002 Bremo Road, Lower Level
Richmond, Virginia 23226
Phone: 804-673-3778
Fax: 804-673-3798
Web site: http://CTEresource.org

The CTE Resource Center is a Virginia Department of Education grant project administered by the Henrico County Public Schools.

NOTICE TO THE READER
The Virginia Department of Education does not unlawfully discriminate on the basis of sex, age, race, color, religion, handicapping conditions, or national origin in employment or in its educational programs and activities.

Introduction

The *Science Standards of Learning Enhanced Scope and Sequence* is a resource intended to help teachers align their classroom instruction with the Science Standards of Learning that were adopted by the Board of Education in January 2003. The Enhanced Scope and Sequence contains

- units organized by topics from the 2003 *Science Standards of Learning Sample Scope and Sequence.* Each topic lists the following:
  - Standards of Learning relating to that topic
  - essential understandings, knowledge, and skills from the *Science Standards of Learning Curriculum Framework* that students should acquire
- sample lesson plans aligned with the essential understandings, knowledge, and skills from the Curriculum Framework. Each lesson contains most or all of the following:
  - an overview
  - identification of the related Standard(s) of Learning
  - a list of objectives
  - a list of materials needed
  - a description of the instructional activity
  - one or more sample assessments
  - one or more follow-ups/extensions
  - a list of resources.

School divisions and teachers can use the Enhanced Scope and Sequence as a resource for developing sound curricular and instructional programs. These materials are intended as examples of ways the understandings, knowledge, and skills might be presented to students in a sequence of lessons that has been aligned with the Standards of Learning. Teachers who use the Enhanced Scope and Sequence should correlate the essential understandings, knowledge, and skills with available instructional resources as noted in the materials and determine the pacing of instruction as appropriate. This resource is not a complete curriculum and is neither required nor prescriptive, but it can be a valuable instructional tool.

Acknowledgments

We wish to express our gratitude to the following individuals for their contributions to The *Science Standards of Learning Enhanced Scope and Sequence* for Grades K–2:

Barbara Adcock
Powhatan County

Jennifer Chang
Loudoun County

Kelly Decker
George Mason University

Laura Domalik
Consultant

Rita Irvin
Montgomery County

Table of Contents

Organizing Topic — Investigation Skills

Related Standard of Learning

1.1 The student will conduct investigations in which
- a) differences in physical properties are observed using the senses;
- b) simple tools are used to enhance observations;
- c) objects or events are classified and arranged according to attributes or properties;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- e) length, mass, and volume are measured using standard and nonstandard units;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials
The students should be able to	
• use their senses and simple tools, such as a magnifying glass, ruler, and thermometer, to enhance their observations of physical properties;	
• classify and arrange objects or events according to at least two attributes or properties so that similarities and differences become apparent;	
• communicate observations made and data collected orally and with simple graphs, pictures, written statements, and numbers;	
• measure length, mass, and volume, using standard and nonstandard units and appropriate instruments. By the third grade, students will be expected to have basic facility with metric measures, including centimeters, grams, and liters;	
• use familiar events and objects to make inferences and draw conclusions;	
• predict outcomes based on actual observations and evidence rather than random guesses;	
• answer questions by conducting simple experiments/ investigations, using simple tools, such as a thermometer, ruler, or magnifying glass. A simple experiment is one that changes only one thing at a time (tests only one variable), gives quick results, and provides easily observable changes.	

15-Bean Soup

Organizing Topic Investigating the Five Senses

Overview Students use many process skills in activities involving dry beans. The various activities included in this lesson are intended to be used sequentially.

Related Standards of Learning 1.1a–h

Objectives

The students should be able to

- observe properties of beans, using their senses;
- classify beans according to attributes or properties;
- graph one tablespoon of beans and compare differences in quantity;
- measure the weight of a bag of beans before opening it;
- predict which beans have the greatest occurrence and which have the least;
- experiment with seasonings to adjust for flavor preferences in soup;
- infer the growth potential of the beans in the bag.

Materials needed

- One 20-oz. bag of 15-bean soup mix
- Balance scale
- One 2-oz. cup for each student
- One bottle of school glue for each student
- One magnifying lens for each student
- One tablespoon
- A 15-Bean Chart (see p. 5) and a 15-Bean Graph (see p. 6) for each student
- Fifteen plastic 8-oz. cups
- Potting soil
- Trays to collect excess water from planting cups

Instructional activity

Content/Teacher Notes

A bag of 15-bean soup mix contains a mixture of 15 types of beans, a seasoning pack, and a recipe for making approximately three quarts of soup. Brands vary slightly as to their composition. Sometimes barley is included.

Introduction

Explain to the students that they will learn some of the skills a scientist uses by studying the ingredients in bean soup. Guide students to identify a bean as a seed and an edible part of a plant. Beans have different shapes and sizes, but most of them can be compared to the shape of an oval. Barley is the seed of a cereal grass.

Procedure

Activity 1

1. Help the children read the label on the outside of the soup-mix bag.

2. Let the students feel the weight of the unopened bag.
3. Pick two or three students at a time to select things in the room that they think will weigh about the same as the bag.
4. Use balance scales to compare the weight of the bag to these things.

Activity 2

1. Prepare enough sample 15-Bean Charts ahead of time for each group of four students to be able to see the glued-on beans clearly. Change the labels as needed to match the beans in your particular bag of soup mix. Ask the cafeteria staff to allow you to borrow enough lunch trays so that each group of four students may use one as a sorting tray; there will be less cleanup at the end.
2. Pour approximately ¼ cup of beans on each tray. Give each student a 2-oz. cup to use to collect one of each kind of bean. Have them count to see if they have all 15 kinds.
3. Show the students the prepared 15-Bean Chart. Tell them you are going to let them make a Bean Chart like the ones on display. Help them read and pronounce the names of the bean labels, and encourage students to use magnifying lenses to see the details of each bean more closely.
4. Provide each student with glue and a labeled 15-Bean Chart. Have the students place small dots of glue in each box and glue on the appropriate bean. Allow time for them to complete their charts, and then set the charts aside to dry.

Activity 3

1. Give each student a 2-oz. cup, glue, and a copy of the 15-Bean Graph page.
2. Let students measure out one level tablespoon of beans and place them in their cup. Have them use the chart from Activity 2 to help them place and then glue their beans in the spaces above each label. Leave graphs lying flat until completely dry.
3. Have children count the beans in each column and identify the column with the greatest number of beans and the column with the least number.
4. Have the students pair up, and help the pairs compare the differences between the two sets of beans. Have them determine the total of all beans on the two charts.

Activity 4

1. Display the finished graphs, and ask children to talk about what they observe. Help them to identify what is the same and what is different among the graphs.
2. Help the students write comparison sentences to correspond to their observations. Examples: “There are more kidney beans than garbanzo beans.” “Some graphs don’t have any garbanzo beans.”

Activity 5

1. See directions on the package for preparing the soup. Review all safety precautions related to being around high temperatures. Inquire about allergies to certain foods and spices. Show children the safe way to smell by wafting — fanning over the top of the container with your hand instead of sniffing directly into the container. Consider *not* using the seasoning packet because of the artificial additives. Ask your cafeteria staff whether they can help with this project.
2. Prepare the soup.
3. Have the children record what things they observe with all five of their senses.

Observations and Conclusions

1. Ask students questions, such as
   - Which beans are new to you?
   - Does everyone's graph look the same?
   - Do you want to try to make more bean soup? Why, or why not?

Sample assessment

- Have students fill in the blanks in the following sentences:
  - My classmate has more _____ beans than _____ beans.
  - Our class together seems to have the greatest number of _____ beans.
  - My favorite bean is _____ because _____.
  - I estimate that the total number of beans left in the bag is _____.
  - The class graph that is most like mine belongs to _____.

Follow-up/extension

- Ask children to discuss whether they think these beans will grow. How could they find out? Provide plastic cups with holes punched in the bottom, potting soil, and a tray to collect excess water. Place two to three of each kind of bean one-inch deep in the soil, and attach the same bean to the outside of the cup with clear tape to serve as an identifying label. Keep soil moist but not too wet. Ask the children to predict which kind of bean will sprout first. Make a chart on which the students may draw pictures of daily observations.
- Soak large lima beans overnight. Split them in half, and have the children identify and label the parts of a bean.
- Purchase bags of split peas, black beans, kidney beans, garbanzo beans, and other beans with distinctive colors. Use them as the color in a drawing for a bean-art project.
- Read stories and nursery rhymes about beans and peas.
- Make a bar graph that corresponds to a selected bean graph. Discuss what is the same and what is different.

Resources

- *Outstanding Science Trade Books for Students K–12*. National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

15-Bean Chart

Large Lima Bean	Green Split Pea	Pink Bean	Black Bean	Black-eyed Pea
Pinto Bean	Baby Lima Bean	Small White Bean	Lentil	Barley
Northern Bean	Garbanzo Bean	Cranberry	Yellow Split Pea	Small Red Bean

15-Bean Graph

10															
9															
8															
7															
6															
5															
4															
3															
2															
1															
Beans:	Yellow Split Pea	Lentil	Large Lima Bean	Garbanzo Bean	Black Bean	Northern Bean	Pinto Bean	Black-eyed Pea	Green Split Pea	Baby Lima Bean	Cranberry	Small White Bean	Pink Bean	Small Red Bean	Barley

Organizing Topic — Investigating Day and Night

Related Standards of Learning

1.1 The student will conduct investigations in which
- b) simple tools are used to enhance observations;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

1.6 The student will investigate and understand the basic relationships between the sun and the Earth. Key concepts include
- a) the sun is the source of heat and light that warms the land, air, and water; and
- b) night and day are caused by the rotation of the Earth.

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials
The students should be able to	
• infer that sunlight striking an object makes the object warmer;	_____
• conduct simple experiments to show how sunlight changes the temperature of land, air, and water;	_____
• demonstrate and describe the concept of rotation;	
• comprehend that day and night are caused by Earth's rotation;	_____
• compare and contrast day and night by characteristic changes in temperature and light;	_____
• model the rotation of Earth and its physical relationship to the sun;	_____
• interpret the relationship between the sun's position in the sky and the general time of day. This includes the sun's relative position in the morning (east), at noon, and in the late afternoon (west).	_____

Light and Dark

Organizing Topic Investigating Day and Night

Overview Students investigate different aspects of day and night, the rotation of the Earth and the sun, and their relationship. The several activities included in this lesson may be used separately or together sequentially.

Related Standards of Learning 1.1b, d, f, g, h; 1.6a, b

Objectives

The students should be able to

- infer that sunlight striking an object makes the object warmer;
- conduct simple experiments to show how sunlight changes the temperature of land, air, and water;
- demonstrate and describe the concept of rotation;
- comprehend that day and night are caused by Earth's rotation;
- compare and contrast day and night by characteristic changes in temperature and light;
- model the rotation of Earth and its physical relationship to the sun;
- interpret the relationship between the sun's position in the sky and the general time of day. This includes the sun's relative position in the morning (east), at noon, and in the late afternoon (west).

Materials needed

- Books and reference materials related to the topic
- Paper model clocks — one for each student
- Favorite Things chart (see p. 12)
- Adding machine paper or drawing paper, pencils, and crayons
- A lamp with bulb
- Picture Notebook or Tablet
- Six identical clear plastic jars: two containing potting soil, two containing water, and two that are empty
- Observations chart (see p. 13)
- Six thermometers

Instructional activity

Content/Teacher Notes

This would be an excellent time to do contrast-comparison attributes for describing the sun and the moon — e.g., hot/cold, light/dark, near/far, large/small, rise/set, quiet/noisy, day/night, front/back, asleep/awake, beginning/end, east/west, turning/stationary, high/low, morning/evening, whole/part.

The Earth is a planet. When comparing things with the Earth, the sun is larger and the moon is smaller. The sun is one of millions of stars seen in the sky. It appears to be larger because it is so much closer to the Earth.

Introduction

Tell the children that they are going to be showing you what they already know about day and night and what they discover about them. Ask the class: Does anyone know what causes day and night? They will likely explain how they are different and the same, using math and language skills learned in lessons about telling time and describing objects.

Procedure

Activity 1: How Long Is a Day?

1. Give students paper model clocks to practice turning (*rotating*) the hands as you count the hours in half of a day and in a whole day.
2. Tell students that you will use the words *rotation* and *rotate* when talking about the Earth. Check for thorough understanding of these words. Check for thorough understanding of the meaning of the terms *minute, hour,* and *day*. Review these terms throughout the study.
3. Help the students create a chart labeled "Daytime Favorite Things" and "Nighttime Favorite Things," or use the one provided. Ask them to predict which side of the chart will have the most things. Have them name favorite things for each column, record their responses, and compare responses with predictions.

Activity 2: What Do We Do in a Day?

1. Give students long strips of adding machine paper or several sheets of paper divided into eight spaces. Have them draw pictures that show sequential events that take place over the course of a whole day — a picture for each time of day.
2. Have them label their pictures "first," "second," "third," etc.; or "early morning," "midmorning," "noon," etc.; or 7:00 a.m., 9:00 a.m., 12:00 noon., etc.
3. Let the students complete at home pictures for the remainder of the day's events and return them the next day. Alternatively, have them predict the events based on previous experience and complete the pictures in class.

Activity 3: What Causes Day and Night?

1. Many students get confused because of the multiple meanings of words. They must be given time to make mental images of the descriptions being discussed. To help students understand the concept of *rotate* (turn around), discuss the ways they may have heard the word used: rotating the tires on a car, rotating crops when farmers plant their gardens, changing who goes first in line, turning the hands on the clock, moving from station to station during learning-center time, and the rotation of the Earth.
2. Have the students stand up, pretend they are the Earth, rotate *once* in very slow motion, and sit down. (Avoid setting up the opportunity for them to get dizzy.) Tell them it takes the Earth 24 hours to rotate once.
3. Have one student come to the front of the room to model the Earth and one student hold a lighted lamp (not a flashlight) to model the sun. Talk about how the sun stays still and the Earth rotates, causing day and night. Be sure all students see the shadow the "sun" casts on the "Earth." Tell them that the real Earth also has a tilt as it turns (rotates) on its axis. While we are having daytime, what is happening on the other side of the Earth?

Activity 4: What Can I Observe in a Day?

1. Pick a sunny day, and tell the class they are going outside for outdoor science three times that day (in the morning, at noon, in the afternoon). This is not the same as recess. You are expecting them to observe things about daytime. Refer to the sun rising in the east and setting in the west. *Safety Note: Caution students against looking directly at the sun!* Ask them to take their picture notebooks and pencils outside with them to draw what they observe.
2. After about 15 to 20 minutes of observation time, discuss their findings. Look specifically for their awareness of shadows, heat, and light. Help them anticipate changes (especially in the shadows).

Ask guiding questions, such as: Would your picture look the same at night? What things would change? How would you draw your picture for night observations? Do we see the moon only at night? Do we see stars in the daytime? (Explain that the sun is actually a star, but that it is much, much closer to us than other stars, and therefore it looks much different.) What would be the same? Different?

Activity 5: What Does the Sun Do?

1. The children should observe that the sun provides heat and light. Ask: How can we know if the sun changes the temperature of things?
2. Place a jar of soil, one of water, and one of air (empty) in a windowsill that gets direct sunlight. (If your classroom windows do not get direct sunlight, use a window elsewhere.) Put a thermometer in each jar. Place three additional thermometers in three other jars with soil, water, and air in a shady spot in the room. Help the students predict the results.
3. Check and compare the six temperatures after the warmest time of the day. Record these temperatures and the time of day.
4. Check and compare the six temperatures at the same time of day on a cloudy day.
5. Have the students compare the cloudy-day temperatures with the sunny-day ones.
6. Lead a class discussion, using questions, such as: How important is sunlight? What happens when the light of the sun is blocked by an object? (A shadow is formed, and things in the shadow are cooler.) What happens when the light of the sun is blocked by clouds? (Everything is in a huge shadow, and everything is cooler.)
7. Provide extra time for more study on shadows if children did not notice the shadow changes in Activity 4. (The shadow study should be a review from kindergarten.)
8. Play Shadow Tag for fun.

Observations and Conclusions

1. Ask the students: What other things can be explained by using contrasts? Consider related map studies (east/west, north/south), arrivals (late/early), music (loud/soft, fast/slow), and economics (needs/wants).

Sample assessment

- Give students a three-column Observations chart with a picture of the sun in the left column, one of the moon in the right, and the middle column for "What I See During Both Times." Have students draw pictures in each.

Follow-up/extension

- Have students make "contrasts" pictures, using paper folded in half. On one half, they make black cutouts on a white background; on the other half, they make white cutouts of the same shapes on a black background.
- Read to the class (or have students read) library books about day and night activities. Be certain the children notice how artists illustrate nighttime scenes.
- Conduct a study of nocturnal animals.
- Let the students make a sunset picture with colored sand (red, orange, yellow, blue, black).
- Play memory games with "opposites" cards.
- Find Web sites with games related to the topic.

Resources

- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Name: _____

Favorite Things

Daytime Favorite Things	Nighttime Favorite Things

Name: _____

Observations

Daytime Observations 	What I See During Both Times 	Nighttime Observations 

Organizing Topic — Investigating Plants

Related Standards of Learning

1.1 The student will conduct investigations in which
- b) simple tools are used to enhance observations;
- c) objects or events are classified and arranged according to attributes or properties;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

1.4 The student will investigate and understand that plants have life needs and functional parts and can be classified according to certain characteristics. Key concepts include
- a) needs (food, air, water, light, and a place to grow);
- b) parts (seeds, roots, stems, leaves, blossoms, fruits); and
- c) characteristics (edible/nonedible, flowering/nonflowering, evergreen/deciduous).

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials
The students should be able to	
• conduct simple experiments/investigations related to plant needs by changing one variable (food, air, water, light, or place to grow) at a time. Students do not need to know the term variable;	_____
• create and interpret a model/drawing of a plant, including seeds, roots, stems, leaves, blossoms, and fruits;	_____
• identify the functions of the seed, root, stem, and leaf;	_____
• classify plants by the characteristics of edible/nonedible, flowering/nonflowering, and evergreen/deciduous, using tables, charts, and picture graphs.	_____

Fun with Plants

Organizing Topic	Investigating Plants
Overview	Students investigate plants. The several activities included in this lesson may be used separately or together sequentially.
Related Standards of Learning	1.1b, c, d, f, g, h; 1.4a, b, c

Objectives

The students should be able to

- conduct simple experiments/investigations related to plant needs by changing one variable (food, air, water, light, or place to grow) at a time;
- create and interpret a model and/or drawing of a plant, including seeds, roots, stems, leaves, blossoms, and fruits;
- identify the functions of the seed, root, stem, and leaf;
- classify plants by the characteristics of edible/nonedible, flowering/nonflowering, and evergreen/deciduous, using tables, charts, and picture graphs.

Materials needed

- Plastic cups with holes punched in the bottom — one per student
- Potting soil
- Tray for collecting excess water
- A shoebox with lid and a large plastic jar with lid
- Quart-size plastic zip bags
- Seeds that will germinate
- Measuring cups and/or tablespoons
- A variety of seeds, leaves, flowers, fruits, and roots (actual or pictures) for display
- Plants That We Eat chart (see p. 20)
- Playing Cards (see p. 19)
- Pictures of plants

Instructional activity

Content/Teacher Notes

Plants can be a lot of fun to study. With a minimum amount of preparation, experiments can be set up to help students truly experience scientific investigation. To prevent over-watering plants, consider using a measuring tool to predetermine and control the amount of water provided to a plant. Also, set up a schedule to determine the times for watering. When conducting experiments, only one variable may change at a time in order to make the results valid; keep all other variables (e.g., type of soil, type of container, position of plant, and so forth) constant.

Introduction

Tell students that they are going to study a lot of things about plants. They will get to observe how plants grow. They will be able to explain how plants are alike and different. They will be able to name the parts of a plant and to tell which ones are safe to eat.

Procedure

Activity 1: Plant Needs

1. Select a type of bean seed that grows quickly. Tell the students that they will be doing a plant experiment for about two weeks.
2. Prepare a plastic cup for each student by punching small holes in the bottom to allow for drainage and filling the cups with potting soil. Give each child three beans to plant approximately one inch below the surface of the soil.
3. Select places in the room to label "No Air," "No Water," "No Light," "No Soil." Guide students to plan setups based on materials available in the classroom. For example, for the experiment with "No Air," the seeds, soil, and water can be placed in plastic zip bags with the air squeezed or sucked out and then taped to a window. Be sure that in each location, only the one applicable plant need is withheld from the seeds, and that the other three needs are supplied.
4. Ask the children to predict what will happen to the seeds in each place. Most of them will probably think that some of the seeds will not sprout at all. Have the students observe and record the amount of sprouting and root growth (if visible) over a two-week period.
5. Discuss plant needs on the basis of the children's observations of the experiment. Which seeds grew the most? Which grew the least? Which needs seemed to be the most important? Which needs seemed the least important?

Activity 2: Parts of a Plant

1. Construct a bulletin board display behind a table by labeling a large sheet of craft paper "Plant Parts" and using illustrations from resource books as a guide and for decoration. Set up a large display on the table to show many varieties of seeds. Provide magnifying lenses for closer observations. Tell children they will be asked to describe the characteristics of some selected seeds, and help them understand that describing words apply to colors, shapes, sizes, textures, number, lengths, and other physical characteristics.
2. After sufficient time has been allowed for study, change the display to show a collection of leaves that have been laminated with cardstock paper as a background. (This actually preserves the color for years.) Children can feel the vein structures and use them for rubbings. At a determined time, change the display to show flower pictures from magazines, artificial flowers, dried flowers, and/or fresh cut flowers. (Watch out for allergies.)
3. Finally, change the display to show "Roots and Fruits."
4. Divide the class into five groups, and have each group draw and cut out leaves, stems, roots, and flowers the size of the precut paper given to them. Have them paste these parts on craft paper to form one giant-sized model. Make labels on 3-by-5 cards and attach.

Activity 3: Plants We Eat

1. Challenge children to come up with names of each plant part that we eat. At the end of the discussion, give the children a page of food pictures to cut out, sort, and paste on a Plants That We Eat chart with the following headings:
   - Seeds — peanuts, sunflower seeds, almonds, cashews, coconut
   - Roots — carrots, radishes, potatoes
   - Stems — celery
   - Leaves — cabbage, spinach, kale, lettuce
   - Flowers — cauliflower, broccoli
   - Fruits — apples, oranges, bananas, pineapples, pears, papayas

2. If you are up to a challenge, plan a "Tasting Party" to allow children to experience the rich variety of flavors in our food choices. Use caution, and do this away from the lab area.

Activity 4: Functions of Plant Parts

1. Prepare a set of eight cards for each pair of children to use to play a memory game similar to "Concentration." Explain the game and practice together as a group by turning the cards face down, shifting them around on the table, and then trying to pick up matching pairs.
   - **Seeds** store food and grow into a new plant.
   - **Roots** absorb (soak up) water and minerals needed for plant growth and hold the plant in place in the soil. (Some roots, such as beets and carrots, store food.)
   - **Stems** hold the leaves and/or flowers.
   - **Leaves** make most of the food needed for the plant to grow.

Activity 5: Plant Groups

1. Tell students that scientists have many ways of grouping things by looking for what is the same and what is different.
2. Collect magazine pictures or clip art of different types of plants. Have the students work in pairs, and give each pair a set of pictures to share.
3. Have the students look at the pictures, name the plant in each picture, and write the corresponding name. Have the pairs share cutting out their pictures. Provide each pair with a double-sided chart that has "I Can Eat This" and "I Can't Eat This" columns on the front and "Plants with Flowers" and "Plants without Flowers" columns on the back. Tell them to sort their pictures these two ways and to glue their pictures in appropriate columns.

Activity 6: Trees Please

1. Discuss the characteristics of the two types of trees: those that lose their leaves in the winter (broadleaf or deciduous trees) and those that keep their leaves all year around (evergreen trees).
2. Plan a field trip to a local park, or take a walk around the schoolyard to find examples of each type. Name the specific variety when you can, or ask a specialist to come to your school and guide the tour for you. Have your tour guide explain the safety precautions needed when selecting fruit and berries that are not known to you.
3. If this tour is done in the fall, children may select a favorite tree and observe and record the changes it goes through during the school year.

Observations and Conclusions

1. Throughout the activities, ask students questions, such as:
   - What have you learned during this study?
   - What was your favorite activity?
   - What are the important life needs of plants?
   - What are the different parts of a plant?
   - What parts of plants do we eat?

Sample assessment

- Collect pictures of trees and/or tree shapes to classify and place on a chart with the headings "Evergreen Trees" and "Broadleaf (Deciduous) Trees."

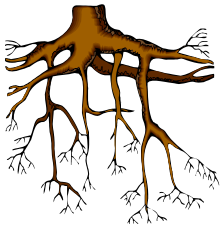
Follow-up/extension

- Have the students read stories and books about plants.
- Have the students write sentences to explain their observations and/or discoveries.

Resources

- *Outstanding Science Trade Books for Students K–12*. National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Playing Cards

Seeds	Roots	Stems	Leaves
			
Grow into a new plant.	Soak up water and minerals and hold the plant in place.	Hold the leaves and flowers.	Make most of the food needed for a plant to grow.

Plants That We Eat

Seeds	Roots	Stems
Leaves	Flowers	Fruits

Organizing Topic — Investigating Animals

Related Standards of Learning

1.1 The student will conduct investigations in which
- a) differences in physical properties are observed using the senses;
- b) simple tools are used to enhance observations;
- c) objects or events are classified and arranged according to attributes or properties;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

1.5 The student will investigate and understand that animals, including people, have life needs and specific physical characteristics and can be classified according to certain characteristics. Key concepts include
- a) life needs (air, food, water, and a suitable place to live);
- b) physical characteristics (body coverings, body shape, appendages, and methods of movement); and
- c) other characteristics (wild/tame, water homes/land homes).

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials
The students should be able to	
• make and communicate observations of live animals, including people, about their needs, physical characteristics, and where they live;	_____
• describe the life needs of animals including air, food, water, and a suitable place to live;	_____
• identify and chart simple characteristics by which animals can be classified, including body coverings (hair, fur, feathers, scales, and shells), body shape, appendages (arms, legs, wings, fins, and tails), methods of movement (walking, crawling, flying, and swimming), wild or tame, and water homes or land homes;	_____
• distinguish between wild animals (raccoon, hawk, squirrel, shark) and tame animals (dog, cat, sheep) and recognize examples of each;	_____
• infer types of animal homes (water or land), using the physical characteristics of the animals, such as scales and fins that allow fish to live and move in water or fur and legs that allow dogs to live and move on land;	_____
• classify animals by where they live (their homes).	_____

Amazing Animals

Organizing Topic Investigating Animals

Overview Students investigate animals. The several activities included in this lesson may be used individually or together sequentially.

Related Standards of Learning 1.1a, b, c, d, f, g, h; 1.5a, b, c

Objectives

The students should be able to

- make and communicate observations of live animals, including people, about their needs, physical characteristics, and where they live;
- describe the life needs of animals, including air, food, water, and a suitable place to live;
- identify and chart simple characteristics by which animals can be classified, including body coverings (hair, fur, feathers, scales, and shell), body shape, appendages (arms, legs, wings, fins, and tails), methods of movement (walking, crawling, flying, and swimming), wild or tame, and water homes or land homes;
- distinguish between wild animals (raccoon, hawk, squirrel, shark) and tame animals (dog, cat, sheep) and recognize examples of each;
- infer types of animal homes (water or land), using the physical characteristics of the animals such as scales and fins that allow fish to live and move in water or fur and legs that allow dogs to live and move on land;
- classify animals by where they live (their homes).

Materials needed

- Videos and books about animal needs, characteristics, and habitats
- Classification charts
- Pictures and/or plastic models of animals
- Magnifying lenses and plastic Petri dishes with taped lids for insect observations
- Class pets and survival equipment (optional)
- Glue, pencils, and crayons

Instructional activity

Content/Teacher Notes

Scientists use animal characteristics to classify animals into groups. Students must be helped to focus on the scientific process skills needed for meaningful study while they are experiencing the excitement of being close to living animals. It is important for them to know how to be observant and how to explain observations with specific descriptors.

Introduction

1. Explain to students that they will be studying animals in a variety of ways. Sometimes they will get information from books or videos. At other times they will have a chance to observe live creatures, including insects. *Safety Note: The children need to understand certain safety precautions necessary for getting close to or touching any animal, including*
    - *how to respond when bees or wasps approach; (Be still.)*
    - *what to do when they want to pick up or touch a pet; (Ask the owner first. Stay calm.)*
    - *what to do when they don't know what the animal is; (Leave it alone.)*

- what to do when they don't know what may be hiding under logs or rocks. (Use a long stick to turn over the rock, have an adult around, and keep a safe distance away.)

Procedure

Activity 1

1. Hold a discussion with the class to complete the information needed on a diagram about life needs of animals and people (see below). Discuss the difference between *needs* and *wants*, an important concept that comes up again in the study of economics.
2. Help students recognize the needs that are the same for both and list them in the middle. Ask: Why are most needs the same for both animals and people?

Life Needs of Animals	Life Needs of Both	Life Needs of People
	1.	
	2.	
	3.	
	4.	
	5.	

Activity 2

1. This would be a good time to help the children see the connection between language arts and science. Help students understand the meaning of describing words, i.e., words used to help name characteristics of animals or properties of objects.
2. Make a class chart like the one below that can be expanded as the unit progresses. Add to the chart any words that the students ask you to spell, and challenge students to use one of these words each time they write a sentence. Create other categories as the vocabulary of the class expands.

Describing Words

Colors	Shapes	Sizes
Height	**Length**	**Weight**
Texture	**Numbers**	**Appearance**

Activity 3

1. Explain that where an animal lives is also called its *habitat*, which provides it with its life needs.
2. Set up a large table station in the room (see example on next page). Divide the tabletop into four color-coded spaces with habitat labels (e.g., green for the Forest, brown for the Pond, yellow for the Desert, and blue for the Ocean). Select appropriate picture books to put on display in each habitat, writing on the colored space the number of books displayed in each. Make sure there are more books than students who will be using them at one time. Add color-coded bookmarks to the books to help students with their return to the correct locations. Identify all words listed in each space, and briefly describe some key features of each habitat. Explain to the students your expectations for proper care and return of the books to the proper locations.

3. Allow students time to look at the books throughout the unit of study. Tell them they get to take turns being the class librarians: each day assign two students who will make sure the books have been returned to the correct spaces. Provide a list of the books' titles for the students to check and match. Add plastic animal models to the display.

Table Display for Habitat Books

Forest (Green) 10 Books	**Pond** (Brown) 3 Books	**Desert** (Yellow) 5 Books	**Ocean** (Blue) 8 Books

Activity 4

1. Check your school library for animal behavior videos, and select one to show the students.
2. Tell students that they will be asked to answer three things about a selected animal: What does it need for survival? What words describe how it looks and behaves? Where does it live, i.e., what is its habitat? Remind students that in order to describe physical characteristics, they must be able to choose appropriate words describing color, shape, size, body coverings, number of legs, appearance, eating habits, etc.
3. Prepare a chart (see below) to help students verbalize these features for a particular animal. If you decide to have a class pet for this observation, choose one that has at least a moderate level of activity. If you decide to collect insects, use plastic Petri dishes with lids so that students can observe safely all sides of the creatures. Have students use a magnifying lens to observe the animals.

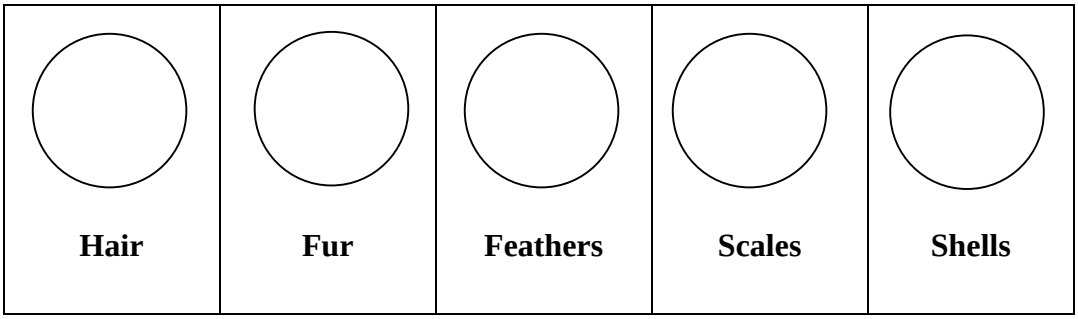
(Animal Name)		
Needs	**Physical Characteristics**	**Habitat**

Activity 5

1. Create a large graph that includes spaces for arms, legs, wings, fins, and tails (see below).
2. Have students add pictures or word cards with the names of animals that have the appendages listed. Ask questions that will help students understand the meaning of the graph results. For example, ask: How many more animals have legs than wings? How many have arms and legs? How many animals are there in all? How many are in more than one group?

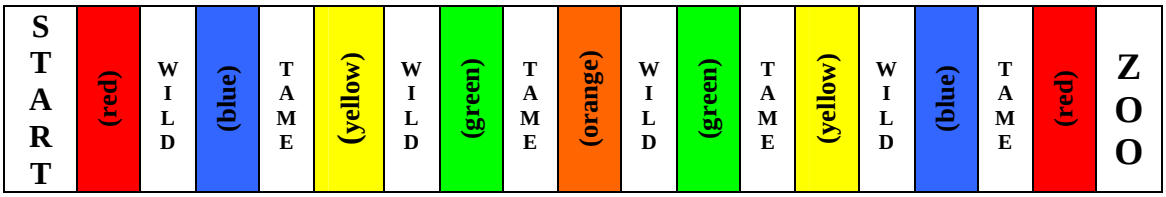
Animals We Observed					
5					
4					
3					
2					
1					
	Arms	**Legs**	**Wings**	**Fins**	**Tails**

To provide another way to classify groups, place a set of labeled circles on a large tabletop or bulletin board, and let students put model animals or pictures for each group specified in/on the circles.



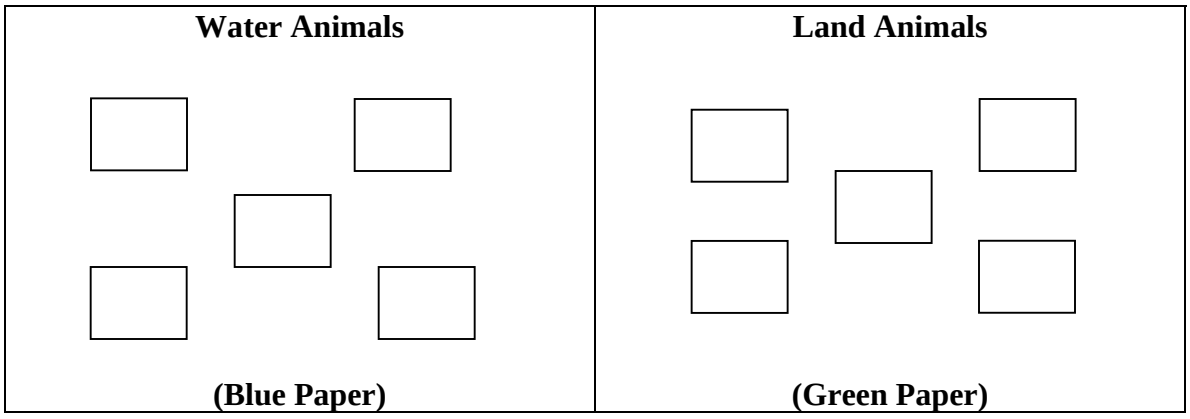
Activity 6

1. Construct a game board (see below) and cards that show various wild and tame animals. Provide an answer key for the students to check their responses. Include game pieces for two to four students. Add a few chance cards, such as "Move ahead 2 spaces," "Lose 1 turn," "Go back to START," "Go to a blue space," etc.
2. Mix up the animal cards and chance cards, and place them face down. The first player chooses a card, looks at the animal, and decides if it is WILD or TAME. He/she then checks the answer key. If correct, he/she moves to the next space with that word. The first player to reach the ZOO is the winner.



Activity 7

1. Give students a collection of animal pictures of various animals, half of which live on land, and half that live in the water.
2. Have students cut out the pictures and place them in the proper spaces on blue or green construction paper.



Observations and Conclusions

- The students should be able to explain at least five ways to classify animals.

Sample assessment

- Word Bank: *scales, air, feathers, arms, food, water, a place, habitat*
  1. Animals need _____, _____, _____, and _____ to live.
  2. A place for an animal to live is also called a _____.
- Circle the right answer:
  3. A tiger is wild tame . A kitten is wild tame .
  4. Birds have feathers fins . Fish have feathers fins .
- Circle the best answer:
  5. When I am asked to describe an animal, I need to
     a. close my eyes.
     b. look for colors, shapes, sizes, and body coverings.
     c. say I don't know how.
     d. tell about how much I like it.

Follow-up/extension

- Ask guests from a local pet shop to visit and explain proper care of pets.
- Plan a field trip to a local zoo or pet store.
- Use this study to help students begin better descriptive writing: The _____ ball is rolling down the _____ street.

Resources

- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.
- *Virginia Department of Game & Inland Fisheries*. http://www.dgif.state.va.us/wildlife/. Web site with wildlife resources about Virginia.

Organizing Topic — Investigating Seasonal Changes and Life Processes

Related Standards of Learning

1.1 The student will conduct investigations in which
- a) differences in physical properties are observed, using the senses;
- b) simple tools are used to enhance observations;
- c) objects or events are classified and arranged according to attributes or properties;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- e) length, mass, and volume are measured, using standard and nonstandard units;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

1.7 The student will investigate and understand the relationship of seasonal change and weather to the activities and life processes of plants and animals. Key concepts include how temperature, light, and precipitation bring about changes in
- a) plants (growth, budding, falling leaves, and wilting);
- b) animals (behaviors, hibernation, migration, body covering, and habitat); and
- c) people (dress, recreation, and work).

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials
The students should be able to	
• identify types of precipitation as rain, snow, and ice and the temperature conditions that result in each one;	_____
• relate a temperature and precipitation chart to the corresponding season (daily or weekly);	_____
• measure and chart changes in plants, including budding, growth, wilting, and losing leaves. Recognize in what season budding and wilting will most likely occur;	_____
• predict how an outdoor plant would change through the seasons;	_____
• compare and contrast the four seasons of spring, summer, fall (autumn), and winter in terms of temperature, light, and precipitation;	_____
• compare and contrast the activities of some common animals (e.g., squirrels, chipmunks, butterflies, bees, ants, bats, and frogs) during summer and winter by describing changes in their behaviors and body covering;	_____
• compare and contrast how some common plants (e.g., oak trees, pine trees, and lawn grass) appear during summer and winter;	_____

- comprehend the concepts of hibernation, migration, and habitat, and describe how these relate to seasonal changes; (It may be useful to recognize common Virginia animals that hibernate and migrate, but specific names of animals are not the focus of student learning here.)
- infer from people's dress, recreational activities, and work activities what the season is.

The Four Seasons

Organizing Topic Investigating Seasonal Changes and Life Processes

Overview Students investigate the four seasons. It would be appropriate to use this lesson four times throughout the year, during each season. Each activity listed can be used for each season. You may wish to have students create a separate "season" journal for each season.

Related Standards of Learning 1.1a–h; 1.7a, b, c

Objectives

The students should be able to

- identify types of precipitation as rain, snow, and ice and the temperature conditions that result in each one;
- relate a temperature and precipitation chart to the corresponding season (daily or weekly);
- measure and chart changes in plants, including budding, growth, wilting, and losing leaves;
- recognize in what season budding and wilting will most likely occur;
- predict how an outdoor plant would change through the seasons;
- compare and contrast the four seasons of spring, summer, fall (autumn), and winter in terms of temperature, light, and precipitation;
- compare and contrast the activities of some common animals (e.g., squirrels, chipmunks, butterflies, bees, ants, bats, and frogs) during summer and winter by describing changes in their behaviors and body covering;
- compare and contrast how some common plants (e.g., oak trees, pine trees, and lawn grass) appear during summer and winter;
- comprehend the concepts of hibernation, migration and habitat, and describe how these relate to seasonal changes; (It may be useful to recognize common Virginia animals that hibernate and migrate, but specific names of animals are not the focus of student learning here.)
- infer from people's dress, recreational activities, and work activities what the season is.

Materials needed

- Weather Chart worksheet (see p. 33)
- Schoolyard Changes worksheet (see p. 34)
- Sprouting Seeds worksheet (see p. 35)
- Four seeds
- Two cups
- Spray bottle
- Paper towels
- Marker
- Water
- Hand lens

Instructional activity

Content/Teacher Notes

It is appropriate to teach the seasons of the year by focusing on each season as it occurs. A suggested timeline for this focus on each season during science would be: *summer* during September, *fall* during November, *winter* during January, and *spring* during April. Each activity listed can be used for each season by having the students create a separate Season Booklet for each season.

Introduction

Literature is a wonderful way to introduce science concepts to young children. There are many Web sites that provide lists of literature associated with science content. Please see the "Resources" at the end of this lesson for some helpful Web addresses.

Procedure

Activity 1

1. This activity is designed to be completed over the course of the year, perhaps during opening exercises each morning. Each day have students complete their own Weather Chart worksheet. These could be kept as part of a Season Booklet or in a separate weather journal.
2. Place a thermometer in the room for a different student to read each day at the same time and report the temperature to the class. Have the students record the temperature and the precipitation that day.
3. Have the students share the weather for the day. Discuss with students, perhaps by using something like a weather bear, what kind of clothes are appropriate for the weather that day.
4. Keep a class chart of the temperatures throughout the year. As the year progresses, discuss with students the trends of the temperatures throughout the seasons.

Activity 2

1. Have students draw an example of what a tree looks like during each season. Have them label each of their drawings with the appropriate season and write/tell about what they would see on the tree at that time of year.
2. Have students draw on sheets a picture of an activity appropriate for each season, labeling each picture with the appropriate season and including some words about the activity. These pairs of pictures should be included in their Season Booklet for the appropriate season.
3. This would also be appropriate at this time to discuss how the hours of daylight change during the year and what effect this has on activities during the seasons.

Activity 3

1. Pick an area in the schoolyard with some plants that will go through changes from season to season. During each season, set aside time for students to go outside and make observations about the plants in the area.
2. Before going out each time, have students predict what they think they will see and record their predictions.
3. Have the students visit the area and make observations. Discuss with students the changes from the previous season that they see, including budding, growth, wilting, losing leaves, etc. Have students use the Schoolyard Changes worksheet to draw a picture of the plants at that time and include a sentence describing the picture. This should also be part of each student's Season Booklet.

Activity 4

For this activity, students will conduct an investigation of whether seeds sprout better under warm or cold conditions. It is best to conduct this activity during spring so that students can compare spring with winter. Also, they can then plant the seeds and see them sprout. This investigation can also be included in their Season Booklet. The procedure is as follows:

1. Mark one cup "Spring" and one cup "Winter."

2. Dampen a paper towel, place the seed on it, fold up the towel, and put it into the "Spring" cup.
3. Repeat step two for the "Winter" cup.
4. Place the "Spring" cup in the classroom and the "Winter" cup in the refrigerator. The "Spring" cup should be kept in the dark as well in order to keep light conditions the same as those of the "Winter" cup.
6. Have students record the temperature of the refrigerator and of the room each day. They can record this in the box along with a picture of their observations of the seeds.
7. Each day, check to see if any changes have occurred to the seeds.
8. Have students complete the Sprouting Seeds worksheet throughout the activity, recording appropriate data.

Activity 5

1. Using some common animals, discuss with students how animals change from season to season. Guide the discussion by showing students pictures of certain animals during the various seasons.
2. Have students pick three or four animals to keep track of throughout the year. For instance you may choose as class animals a chipmunk, bear, bee, and frog. During each season, "check in" on the animals to see what they would be doing at that season. Provide students with pictures and examples and perhaps an appropriate story about one.
3. Have each student pick one animal to keep track of in his or her Season Booklet and draw a picture each season about what the animal would be doing at that time and what it would look like. Have them also write a description of the animal at that time. At the bottom of each picture, have them write a prediction about what they think the animal will be doing in the next season.

Sample assessment

- Throughout the year, assessments may be given during each season that specify the characteristics of that season. The Season Booklet may be used as an assessment for each season.

Follow-up/extension

- Have students make a collage of animals, plants, and activities that represent a particular season.
- Have students make a graph of the weekly temperatures.
- Have a share day for each season on which students bring in something that represents that season.

Resources

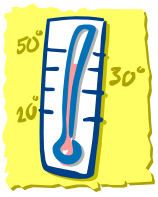
- *Connections: Connecting Books to the Virginia SOLs.* http://www.fcps.edu/cpsapps/connections. Web site with a searchable database of children's books to use to teach the Virginia SOL.
- *Harcourt Science,* Grade One, 2002. The seed activity is adapted from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.
- *Songs for Teaching: Using Music to Promote Learning.* "Preparing for Winter." http://www.songsforteaching.com/sarajordan/preparingforwinter.htm. Web site with songs for teaching science.

- *PBS TeacherSource.* http://www.pbs.org/teachersource/. Web site with lesson plans on various subjects.
- *Virginia Department of Game & Inland Fisheries: Wildlife Education.* http://www.dgif.state.va.us/education/wildlife_education.html. Web site with information on schoolyard habitats and grants available.

Name: _____

Weather Chart for _____

(Month)

DATE →	Monday ____	Tuesday ____	Wednesday ____	Thursday ____	Friday ____
Temperature 	°F	°F	°F	°F	°F
Clouds or Sun 					
Precipitation 					
Wind 					

Name: _____

Schoolyard Changes

Season: _____

Description: _____

_____

Name: _____

Sprouting Seeds

My prediction: Fill in "warm" or "cold."

I think the seeds that are _____ will sprout faster.

My observations: Draw a picture of what the seeds look like each day.

	Observations	
	Warm	**Cold**
Day One		
Day Two		
Day Three		
Day Four		
Day Five		

My conclusion: Fill in "warm" or "cold."

The seed that was _____ sprouted faster.

Organizing Topic — Investigating Natural Resources

Related Standards of Learning

1.1 The student will conduct investigations in which
- a) differences in physical properties are observed using the senses;
- b) simple tools are used to enhance observations;
- c) objects or events are classified and arranged according to attributes or properties;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- e) length, mass, and volume are measured using standard and nonstandard units;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

1.8 The student will investigate and understand that natural resources are limited. Key concepts include
- a) identification of natural resources (plants and animals, water, air, land, minerals, forests, and soil);
- b) factors that affect air and water quality; and
- c) recycling, reusing, and reducing consumption of natural resources.

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials

The students should be able to

- identify natural resources, such as plants and animals, water, air, land, minerals, forests, and soil; _____
- recognize that many natural resources are limited; _____
- compare and contrast ways of conserving natural resources. This includes recycling, reusing, and reducing consumption of natural resources; _____
- classify factors that affect air and water quality; _____
- describe ways students and schools can help improve water and air quality in our communities; _____
- determine some basic factors that affect water quality by conducting simple investigations in the school environment. The students should be able to make and record observations of what happens to runoff water on rainy days; (related to 1.3) _____
- predict what would happen if natural resources were used up, and explain ways to prevent this from happening; _____
- discuss the value of parks to wildlife and to people. _____

What Are Natural Resources?

Organizing Topic Investigating Natural Resources

Overview Students have a broad overview of natural resources and identify manmade items made from these resources.

Related Standards of Learning 1.1a, c, h; 1.8a

Objectives

The students should be able to

- identify natural resources, such as plants and animals, water, air, land, minerals, forests, and soil.

Materials needed

- Science Journals
- Potted plant (to represent trees and other plants)
- Stuffed animal (to represent live animals)
- Bag of soil (to represent soil)
- Rock (to represent minerals)
- Molasses or chocolate syrup (to represent oil)
- Empty jar (to represent air)
- Jar full of water (to represent water)
- Natural Resources Chart (see p. 40)

Instructional activity

Content/Teacher Notes

Natural Resources

- Plants: Plants are living things that can produce their own food. Trees, shrubs, grasses, seaweed, and some microscopic algae are examples of plants. Green plants produce oxygen. They also produce food for animals that eat plants.
- Animals: Most animals can be defined as living things that rely on other organisms for food. Animals have a nervous system and can usually move on their own. Examples of types of animals are mammals (includes humans), birds, reptiles, amphibians, fish, and invertebrates, such as insects, spiders, and worms. Some microscopic living things are also classified as animals.
- Water: Plants use water when manufacturing their food, and animals drink or absorb water to maintain bodily functions. Some animals live in water, and some use it as a place from which to get food, to seek protection, or to cool off. Fresh water on land is replenished by the water cycle and is essential to all living things.
- Air: Animals need oxygen in air to breathe, and plants use carbon dioxide in air in the process of photosynthesis. The gases are recycled through plants and animals.
- Soil: Soil is a mixture of minerals from weathered rock and decaying plant and animal matter. It also consists of microscopic living things, such as bacteria and fungi. Most plants that live on land need soil in which to grow, and soil provides water and nutrients to plants. Many animals live on or in soil.
- Minerals: Minerals are naturally occurring substances that originally came from rock, such as phosphorous, bauxite, iron, salt, gold, silver, copper, and potassium. Many minerals are essential for the healthy growth of plants and animals, and plants absorb minerals that are dissolved in

water. Animals must obtain needed minerals by eating plants or other animals that have eaten plants.

- Forests: Forests moderate climate, help cleanse the air and water, and house wildlife. They also provide thousands of wood products and related jobs. Virginia's forests are diverse. From the extensive loblolly pine forests of the flat, low-lying Coastal Plain, through the patchwork of pines and hardwood forests of the rolling Piedmont, to the white pine and upland hardwoods of the western mountains and valleys, forests wear many faces.

Energy Sources

- Sunlight: The energy derived from sunlight is used by green plants for photosynthesis. Sunlight also powers the water cycle by evaporating water from land and bodies of water. Note that sunlight is not addressed in this lesson, because the lesson focuses on the connections between natural resources and manufactured items.
- Fossil Fuels: Fossil fuels include crude oil, coal, and natural gas. The fossil fuels we use today originated from partially decayed plants and animals that lived millions of years ago. In this lesson students are introduced to crude oil. The crude oil that we use today came from marine plankton that lived millions of years ago. These marine plants died, and over much time, tremendous pressure and heat, created by layers of rock that trapped the plants, caused crude oil to form.

Introduction

Ask students to draw or describe in their journals something that comes from nature. Share their entries with the class as you write their responses on the board.

Procedure

1. Show students the following items, each representing a category of natural resources: potted plant, stuffed animal, soil, rock, and molasses. Tell students that things that come from nature are called *natural resources.* All living things need some natural resources in order to live.
2. Help students identify each category of natural resources as you list them on the chalkboard: plants, animals, water, air, land, minerals (rocks), forests, energy sources (sunlight, fossil fuels, such as oil), and soil.
3. Ask students to draw a symbol for each category of natural resources. Students may work in groups to do this, with one group assigned to each category. Have each group share their symbol.
4. Give each pair of students a Natural Resources Chart. (The chart focuses on only five of the categories, since air and water are very commonly used in the manufacturing of most products.) Describe how to complete the chart: that is, students should draw or write things they see that come from the natural resources listed on the chart.
6. In preparation for a trip outside the classroom, ask each pair of students to bring their chart, pencils, and a clipboard (or something hard to write on). Help students identify things that are part of nature. Ask them what natural resources they see (or feel, in the case of air). Ask them what they see that people have made from natural resources. For example: What do you see that is made from a plant? (a wooden bench).
7. Help students complete their charts by selecting one item on the school grounds on which to focus and deciding what natural resource or resources were used to make it.

Observations and Conclusions

1. Back in the classroom, have students respond to the following by writing or drawing in their journals:
   - I saw _____.
   - _____ is a part of nature.
   - One thing that I saw that was made by people is _____.
   - The natural resource or resources from which this thing was made are _____.
2. Ask students to share their journal entries.
3. Discuss with students any items seen indoors and outdoors that were different but that came from the same natural resource.
4. Also discuss any items that were similar but that came from different natural resources.

Sample assessment

- Assess charts and journals completed during class.

Follow-up/extension

- Bring in several items from home, and hold a discussion about what the items are and from what natural resource(s) they are made.

Resources

- *California Integrated Waste Management Board Publications.* "Closing the Loop: Exploring Integrated Waste Management and Resource Conservation." http://www.ciwmb.ca.gov/Publications/default.asp?pubid=834. This lesson is adapted from this source.
- *Virginia Naturally: Virginia's Natural Resources Education Guide.* http://www.vanaturally.com/guide.html.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Name: _____

Natural Resources Chart

Natural Resource	Object Made by People, Using This Resource
Plants	
Animals	
Soil	
Minerals	
Forests	

Let the Sun Shine In!

Organizing Topic Investigating Natural Resources

Overview Students observe that muddy water blocks sunlight. They consider ways that soil might get into water, and they make inferences about its effects on underwater grasses, crabs, and other animals. They dramatize connections between the sun, the Earth, and eelgrass, as well as between people on land and blue crabs in an eelgrass environment.

Related Standards of Learning 1.1c, f, g, h; 1.8a, b, c

Objectives

The students should be able to

- identify natural resources, such as plants and animals, water, air, land, minerals, forests, and soil;
- compare and contrast ways of conserving resources. This includes recycling, reusing, and reducing consumption of natural resources;
- classify factors that affect air and water quality;
- describe ways students and schools can help improve water and air quality in our communities;
- determine some basic factors that affect water quality by conducting simple investigations in the school environment. Students should be able to make and record observations of what happens to runoff water on rainy days.

Materials needed

- One jar of clean water
- One jar of muddy water
- Flashlight with batteries
- One bunch of artificial eelgrass
- Two shells from blue crabs
- One dried seahorse specimen
- Three stuffed animal blue crabs
- One small stuffed animal fish
- One T-shirt imprinted with blue crab image
- One T-shirt imprinted with large fish image
- Two tree branches
- One bunch of artificial flowers
- Two green mats representing lawn grass
- One yellow painted “sun” on poster board or wood
- Seven eelgrass costumes, made of blue felt and green ribbons
- Eight brown cloth rectangles
- One blue paper “blue crab” shape per student plus one yellow paper 3" square (1/12th of a sheet of construction paper) per student
- Eight green paper 3/4" x 9"strips (16 strips cut from a sheet of construction paper) per student
- Let the Sun Shine In! script (see p. 43)

Instructional activity

Content/Teacher Notes

When sediment from soil erosion enters the Chesapeake Bay and its tributaries, it blocks sunlight that eelgrass and other submerged aquatic plants need to live. Then, without these underwater plants, young aquatic animals lack protective habitat and sufficient dissolved oxygen. Some erosion will inevitably occur, especially during severe storms; however, conserving trees and other rooted plants on land can help control much erosion. (See http://www.vanaturally.com/bayandcoast.html for more detailed background on the Bay and coastal areas of Virginia.)

Introduction

Show crab shells, seahorse, artificial eelgrass. Discuss with the students the value of eelgrass as a habitat for crabs, seahorses, etc. Ask: If you were a little blue crab or little fish, why would you be happy to have eelgrass nearby? (It's a hiding place. It's a source of oxygen.)

Procedure

1. Show the jar of clear, clean water and the jar of muddy water. Ask: How does river or Chesapeake Bay water become muddy? What problem could muddy water be to fish, or clams, or oysters? Can sunlight shine through both kinds of water? Demonstrate this in a darkened room, using a flashlight shining through the clean water onto the wall but not shining through the muddy water. Ask: In which kind of water would underwater green plants grow better? Why?
2. Pass out costumes and props for a play. Narrate and direct the action of the play as the children follow the direction.
3. Pass out craft materials. Have students assemble a paper collage of a blue crab in an eelgrass environment with the sun overhead.

Observations and Conclusions

1. Pause at the conclusion of the play to ask
    - Why are no more blue crabs or young fish left in our play? (The jimmy crab and the big fish ate them.)
    - Why could the jimmy crab and big fish find the blue crabs and young fish so easily? (The eelgrass died.)
    - Why did the eelgrass die? (The sunshine did not go through the water.)
    - Why couldn't the sun shine through the water? (Soil made the water muddy, and light does not pass through muddy water.)
    - Is soil bad? (No, soil is valuable on land. Soil was knocked off the land by the wind and rain.)
    - Are wind and rain bad? (No, plants on land need rain water.)
    - How did the soil become loose so that the natural wind and rain could make it run into the water? (People cut down trees, dug up grass, and pulled up flowers by their roots. Roots could no longer hold soil securely on the land.)

Sample assessment

- Have students construct the collage showing eelgrass providing protection for a blue crab and answer questions about how the parts of the collage relate to each other. For example:
    - Why do you need to include an image of the sun? (To show that eelgrass needs sunlight.)

- Why do you need to include images of eelgrass? (To show that blue crabs need eelgrass for protection.)

Follow-up/extension

- Have the students plant and care for grass, ground cover, flowers, trees, or shrubs.
- Let the students perform an experiment in which they mix different materials with water to see which mixtures allow light to pass through.
- Have students place some potted plants in light and others in dark and then observe their growth over time.

Resources

- *Virginia Naturally: Virginia's Natural Resources Education Guide.* http://www.vanaturally.com/guide.html. This lesson is adapted from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

LET THE SUN SHINE IN!
Script & Stage Directions

"Soil was secure on the land.... *Soil characters stand in two lines facing each other across the space representing water.*

...because flowers and grass and trees were growing on the land." *Each flower, grass, and tree character stands behind a soil character, one hand holding a prop and the other hand on the soil character's shoulder.*

"The sun was shining through the water of the Chesapeake Bay and on the trees, grass, and flowers on the land, making them warm." *Sun character stands in front of a window facing other characters.*

"Warmed by the rays of the sun coming through the water, eelgrass was growing under the water of the Chesapeake Bay." *Eelgrass characters form circle holding hands in center of area representing water*.

"Blue crabs were hiding in the eelgrass." *Stuffed animal blue crabs are placed inside the eelgrass circle.*

"Young fish were hiding in the eelgrass." *Stuffed animal fish is placed inside the eelgrass circle*.

"Big ole Jimmy Crab couldn't find soft crabs or fish to eat." *Jimmy Crab enters, walking sideways; pinches the eelgrass ribbons; pretends not to see blue crabs or young fish.*

"Big Fish couldn't find soft crabs or fish to eat." *Big Fish enters with swimming motion; circles the outside of the eelgrass circle; pretends not to see blue crabs or young fish.*

"People came and chopped down trees; scraped up grass; pulled up flowers." *Character models tree chopping with imaginary ax or chain saw, digging up grass with imaginary shovel, pulling up flowers by the roots. Tree, flower, and grass characters return to desks.*

"Soil got loose; rain mixed with it; it became mud and slid into the water." *Soil characters wiggle; walk slowly into water area; then form circle around the eelgrass circle, facing outward.*

"Sunlight could not get through the muddy water to the eelgrass, so the eelgrass died." *Sun character walks toward each soil character; each soil character blocks sun's passage. Eelgrass characters drop hands; then slowly sink down.* "Now the crabs and fish have no place to hide."

"Will the big, hungry Jimmy Crab and Big Fish find and eat them?" *Jimmy Crab and Big Fish see and catch the stuffed animal blue crabs and fish and then return with stuffed animals to desks.*

"Why are no more blue crabs or fish left in our play?" *Students return costumes and props to proper places and then return to their desks to discuss answers to the question.*

Reduce, Reuse, Recycle

Organizing Topic Investigating Natural Resources

Overview Students make planters out of recycled paper and plant seeds or seedlings.

Related Standards of Learning 1.1a, b, d, g, h; 1.8a, c

Objectives

The students should be able to
- recognize that many natural resources are limited;
- predict what would happen if natural resources were used up, and explain ways to prevent this from happening.

Materials needed

- Samples of various types of paper, including some made from recycled fibers. These could include cereal boxes (chipboard), magazines (coated with clay), newsprint (most has recycled content), white paper, construction paper, and paper made by students
- Magnifying lens
- Microscope
- Small (6 oz.) milk cartons or yogurt containers
- A few stacks of newspapers
- Seeds to plant in the paper planter (may be donated by nurseries)
- Approximately one cup of soil for each paper planter

Instructional activity

Content/Teacher Notes

Lumber mill wastes, together with wood that is unsuitable for use as lumber, are used to manufacture paper. To save transportation costs, paper mills are usually located near the forests where the trees are harvested. To make paper, the trees are debarked, chipped, mixed with chemicals, and processed in a large steam-heated pressure cooker called a digester. This helps to break down the wood into cellulose fibers. The fibers are then rinsed with water to remove chemicals, unwanted wood contaminants, and dirt. The remaining water-wood mixture, called slurry, is fed onto a screen and shaken to intermesh the cellulose fibers. Water is drained through the screen, and the remaining sheet of paper passes through a series of rollers where it is pressed. Heated rollers dry the paper. The dried paper is cut and placed on smaller rolls or cut into large sheets.

In 1995, approximately 31 percent of residential waste consisted of paper. This wastepaper could have been recycled. The paper recycling process is very similar to the process of making paper in the first place. The paper is chopped up and mixed with water to make a pulp slurry. Then it is put through a series of washing and/or flotation de-inking processes in which water and/or soap-like chemicals (called surfactants) remove the ink from the paper. Water is drained through the screen, and the remaining sheet of paper passes through a series of rollers where it is pressed and dried. The dried paper is slit into smaller rolls or large sheets. Later it is cut to desired size.

Paper may contain new fibers as well as recycled fibers. Papermaking fibers can typically be recycled five to seven times before they become too short to be recycled again. Successful recycling requires clean used paper, which is free of contaminants such as food, plastic, metal, and other garbage. Corrugated boxes, newspapers, and office paper are kept separate because the different grades of paper

are used to make particular types of recycled paper products. Recycling paper conserves natural resources. It

- saves trees (most of which are grown on tree farms);
- saves energy because it takes 30 to 60 percent less energy to produce recycled paper as it does to make the same type and weight of paper from trees;
- reduces air pollution from pulp mills by 74 to 95 percent and lowers water pollution by 35 percent;
- reduces the amount of paper going to the landfill, therefore extending the life of the landfill.

Introduction

1. Read the class a book about being a friend to trees and about recycling. Discuss the following questions with students:
    - From what material is most paper made? From what category of natural resources is most paper made?
    - What are some other ways that plants are important?
    - Who and what depends on trees and other plants to survive?
    - What can we do to conserve trees — that is, use fewer and avoid wasteful use of trees?
2. Provide samples of various types of paper, including some made from recycled fibers and some from nonrecycled fibers. Have students make observations, using a magnifying glass and/or microscope. Discuss the following questions with students:
    - What do you see when you look at the paper through a magnifying glass?
    - What differences did you see between paper made from recycled fibers and that made from nonrecycled fibers?
    - How do you know if something is made from recycled materials?

Procedure

Have the students make paper planters, using the following steps:

1. Make a paper-pulp mixture by soaking newspapers overnight in water. Stir the mixture to break the fibers down into a substance that can be bonded together again to form recycled paper.
2. Divide class into groups of three or four students each. Provide each group with newspapers (to be spread in their work area) and a small milk carton with the top cut off, or a similar container.
3. Have students take a handful of the pulp mixture and squeeze as much water out of it as possible back into the bucket or pan. Then have them use dry pieces of newspaper to press out more excess water from the pulp mixture. This step is very important, or their paper planters will take too long to dry.
4. Have the students mold the pulp about ¼-inch thick inside a small milk carton or similar container.
5. Then show the students how to use additional pieces of newspaper to remove more excess water from inside the paper mold.
6. Allow the planters to dry completely inside the cartons (about 3 days). You might set these out in the sunlight for a few hours each day. Once dry, take the molded paper planters out of the milk cartons.
7. Provide students with soil, and let them plant a few seeds in their planters. If the seeds are from native wildflowers, once they mature, students may plant them at home or on the school grounds. Be sure they understand that when planting the seedlings, they should place the entire paper planter with the plant in the ground, as the paper planter will decompose.

Observations and Conclusions

1. Have the students repeat the observations of various types of paper and make conclusions, using the questions from the Introduction to the lesson, step 2:
   - What do you see when you look at the various types of paper through a magnifying glass?
   - What differences did you see between paper made from recycled fibers and that made from nonrecycled fibers?
   - How do you know if something is made from recycled materials?

Sample assessment

- Have students make a list of the benefits of recycling and of using recycled paper.

Follow-up/extension

- Let students make recycled sheets of paper.
- Visit a paper mill plant.
- Plan and begin a paper recycling project in the school, if there is not one already.

Resources

- *California Integrated Waste Management Board Publications.* "Closing the Loop: Exploring Integrated Waste Management and Resource Conservation." http://www.ciwmb.ca.gov/Publications/default.asp?pubid=834. This lesson is adapted from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

The Is-It-Litter? Box

Organizing Topic Investigating Natural Resources

Overview Students use their senses of sight and touch to identify and respond to information about their surroundings. They also increase their vocabulary skills and draw a picture related to their observations.

Related Standards of Learning 1.1a, c, f, h; 1.8a

Objectives

The students should be able to

- identify natural resources, such as plants and animals, water, air land, minerals, forests, and soil;
- compare and contrast ways of conserving resources. This includes recycling, reusing, and reducing consumption of natural resources;
- describe ways students and schools can help improve water and air quality in our communities.

Materials needed

- Covered box
- Man-made and natural items of litter — at least one item per student and none with sharp edges
- Paper
- Crayons

Instructional activity

Content/Teacher Notes

Natural items might be thought of as those objects that are "made by nature." *Man-made items* refer to objects that are "made by human beings or by machines." Objects found in inappropriate places should be considered *litter*. When people use waste containers or recycling bins instead of dropping or throwing items just anywhere, less litter and pollution is generated. For young students, litter is a good example of *pollution*, which can be defined as things, often by-products of production, that are harmful to our health and to the environment. Litter is ugly, and less litter and pollution make communities more attractive and healthier places in which to live.

Introduction

1. Lay all of the items of litter on a table. Tell the students that there are both "natural" and "man-made" items lying on the table.
2. Hold up a natural object, and ask the students whether they think it was made by nature or by people. After a short discussion, repeat the question while holding up a man-made object.
3. Summarize/establish a working definition for both of the terms *natural* and *man-made.*

Procedure

1. Have students think about being outside on the playground or in a place with which they are all familiar. Pick two or three man-made objects from the table. Ask students if they would think the playground is littered if they were to see these man-made items lying around. Discussion questions might include: Why? Would they be out of place? Is this pollution? Where should those items be placed so that they are no longer littering the playground? What are some ways you can prevent pollution at school? In your neighborhood? Can any of the items be recycled? Are there recycling containers in the school? If so, where are they?

2. Put some man-made items on the floor. Ask the students to imagine they are eating lunch and they see these items on the floor. Put a few natural items from the table on the floor. Help the students determine whether these items should also be removed from the floor and where they might be placed. Help students conclude that trash out of place becomes litter.
3. Put all of the items in the box, and let students know that they will play a game that will be very tricky so they should listen carefully. Explain that they will now pretend that all of the items in the box are lying along the side of a road. They will be able to pull out two objects — one that is natural and one that is man-made — but the tricky part is that they cannot use their eyes to see in the box to help them decide which items to pull out! Instead, they will use their fingers carefully to feel what the items are. *Safety Note: Make certain that none of the items have sharp edges!*
4. Give each student the opportunity to close their eyes and pull both a natural and a man-made object out of the box. Have each student explain which of their objects might be found naturally on the side of the road and which might be considered litter.
5. Have the students draw a picture of themselves throwing their litter into a trash can or recycling bin. The students should take their pictures home to help them remember what they learned about where litter should be placed.

Observations and Conclusions

1. Have students observe and record examples of litter. Then have them discuss what is and is not litter, why it is there, and why they should be concerned about litter.
2. Have each student draw a picture illustrating his/her main litter concern and present the picture to the class, describing his/her concern.

Sample assessment

- Assess student drawings.
- Make a chart of man-made and natural items.

Follow-up/extension

- Have students create posters or a bulletin board to remind the school of the importance of this topic.

Resources

- *Pollution Solutions: Litter Prevention Activities for Virginia Teachers*. Virginia Resource-Use Education Council. http://www.deq.state.va.us/education/polsul/homepage.html. This lesson is adapted from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Henry Heron: A Litter Story

Organizing Topic Investigating Natural Resources

Overview Students listen to a short story and then sequence the order of the story's events and predict a conclusion.

Related Standards of Learning 1.8a, b, c

Objectives

The students should be able to

- identify natural resources such as plants and animals, water, air, land, minerals, forests, and soil;
- compare and contrast ways of conserving resources. This includes recycling, reusing, and reducing consumption of natural resources;
- describe ways students and schools can help improve water and air quality in our communities;
- discuss the value of parks to wildlife and to people.

Materials needed

- Six-pack plastic ring
- "Henry Heron" story (see next page)

Instructional activity

Content/Teacher Notes

Animals need food, water, air, and space. The water and the space must be clean and free of litter to provide a safe and healthy habitat.

Introduction

Ask for a show of hands of students who have recently visited a park with a lake. Discuss the things they saw around the lake, eventually guiding the discussion toward trash or litter they might have seen. List all litter items the students remember seeing. Ask: Was this litter ugly there? Did it make the park look bad? Was it dangerous to you? To other people? To animals? Guide the discussion toward any birds the students may have seen and how the litter might hurt the birds and other animals.

Procedure

1. Read "Henry Heron: A Litter Story" to the class, stopping in the middle to have students predict what will happen to Henry. After finishing the story, discuss how Henry might have felt, how the people helping Henry might have felt, and what might have happened differently.
2. Slip a large rubber band onto your thumb and little finger over the back of your hand. Ask the students if they think it will be easy for you to remove the rubber band without using your other hand. Demonstrate how hard this is to do. Let several or all of the students try, and discuss how hard it is to remove the rubber band. Talk about how animals have trouble removing items that get caught around their feet or necks since they don't have hands and fingers to help remove the items.
3. Show a six-pack ring, and pass it around so students can try to tear it to see how strong it is. Tell the students that years ago when garbage was often dumped in the sea, people recommended cutting rings before disposing of them so that they could not hurt birds and other animals. These days trash in Virginia is recycled, put in landfills, or incinerated. Therefore, when these rings are recycled or disposed of properly, cutting them is not necessary.

Sample assessment

- Ask students the following questions:
  - What are some examples of litter?
  - How can litter be dangerous?
  - What can you do to lessen the amount of litter?

Follow-up/extension

- Have students suggest their own ending to the story, or have them retell the story. Students may also illustrate their endings.
- Have students draw a cover picture for the Henry Heron story that suggests what happens.

Resources

- *Pollution Solutions: Litter Prevention Activities for Virginia Teachers*. Virginia Resource-Use Education Council. http://www.deq.state.va.us/education/polsul/homepage.html. This lesson is adapted from this source.
- *Outstanding Science Trade Books for Students K–12*. National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

HENRY HERON: A LITTER STORY

Henry is a heron. He likes to hang out at the park's lake. He often stands as still as a statue and waits for minnows to swim by so he can grab a quick snack.

Henry is a very curious heron and always explores the nooks and crannies of the lakes and rivers he visits. One day Henry saw something stuck in the grass near the edge of the lake. "I wonder what that could be?," he thought excitedly as he went closer. "Oh, it's only a soda can," he sighed. "Another piece of trash left by a lazy person. I don't know why people can't be neater!!"

Just as he was about to wade away, Henry saw a minnow skimming through the water. He did exactly what comes naturally to herons. His head went down and he came up with the minnow in his beak. "Yum!," he said as he swallowed the minnow. "I love good food."

Then Henry noticed he had caught more than just the minnow. The minnow had gone beneath a plastic six-pack ring, and as Henry had reached to get it, his head had gone through the ring. It was stuck on his long neck!

Henry shook, he wiggled, he rubbed against the grass, he stuck his head into the water, but nothing he did would remove the plastic ring. "This is terrible, horrible, awful," Henry announced to the world. But no one was listening. Henry gave one more long, lonely shake of this head.

Morning dawned, and Henry stretched, but was brought up short. The plastic ring pulled and squeezed his neck, and made it very hard for Henry to breathe. Then some park visitors saw Henry. They chased him, trying to catch him. We know they just wanted to help Henry, but all Henry knew was that he was scared and wanted to get away. He wished he could disappear. He flew away and landed in a nearby clearing.

After a while Henry got hungry and came out to the middle of the lake. He tried to catch some fish, but the plastic ring kept getting in the way, or it moved and scared the minnows away. How could he

catch some fish? Henry flew to the shore, still hungry. When he got there, he was again chased by people. This time, the people were in uniforms.

The next day Henry was tired, hungry, and terribly discouraged. He went over to the other herons. They also chased him away. “You’re scaring all the fish away. You’re making people chase us. You look stupid with that plastic ring thing around your neck!”

“I didn’t get it stuck on myself on purpose,” Henry said. “I tried to get it off.” But the herons just flapped their long wings and left Henry. One of them even pecked at Henry, and you know that had to hurt!

(Teacher Note: Stop here. Ask the students to predict what they think might happen to Henry.)

Henry was resting quietly in a cove of reeds when suddenly he was covered with a net. He flapped and struggled, but he couldn’t get away. When hands reached for him, he snapped at them with his long beak. The people wouldn’t give up. They finally got a good hold on Henry and tried to calm him. They held his neck very still and clipped the plastic ring and then pulled it off. When they released Henry, he flapped his wings and flew across the lake. Once he had calmed down, he realized the people had helped him and had removed the plastic ring.

“Yes,” he said. “I can eat again! I can drink!” and he dipped his head into the water. “I can sleep and eat and do almost anything!!!” Henry was so excited!

Note to teachers

It would be nice to say to the students that Henry is safe for the rest of his life, but since there is so much litter around, that probably is not the case. Many animals never get rescued in the first place, and those that do may get caught in litter again. Animals probably do not realize that litter is dangerous to them, and they often do not remember what has happened to them in the past like people do. They may even think a piece of litter looks like something interesting to eat and go after it on purpose. We can help by always putting our trash in the right places.

Organizing Topic — Investigating Interactions with Water

Related Standards of Learning

1.1 The student will conduct investigations in which
- a) differences in physical properties are observed using the senses;
- b) simple tools are used to enhance observations;
- c) objects or events are classified and arranged according to attributes or properties;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- e) length, mass, and volume are measured using standard and nonstandard units;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

1.3 The student will investigate and understand how different common materials interact with water. Key concepts include
- a) some liquids will separate when mixed with water, but others will not;
- b) some common solids will dissolve in water, but others will not; and
- c) some substances will dissolve more readily in hot water than in cold water.

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials
The students should be able to	
• describe and apply the term *dissolve*;	_____
• predict and describe how various materials (vinegar, milk, baking soda, powdered drink mix, sugar, salt, sand, oil, soil, rocks) act when mixed with water;	_____
• classify liquids and solids into those that will dissolve in water and those that will not. Use picture graphs, tables, and/or charts to record and display the information;	_____
• infer that some substances will dissolve more easily in hot water than in cold water by conducting investigations using water at different temperatures.	_____

Mix It Up: In Hot Water

Organizing Topic	Investigating Interactions with Water
Overview	Temperature plays an important role in any mixing experiment. Students determine whether solids dissolve more readily in hot water or in cold water.
Related Standards of Learning	1.1a, b, c, e, f, g, h; 1.3c

Objectives

The students should be able to

- infer that some substances will dissolve more easily in hot water than in cold water by conducting investigations using water at different temperatures.
- describe and apply the term *dissolve*.

Materials needed

- Sugar
- Borax (found near laundry detergent in the grocery store)
- Baby powder without talc
- Salt
- Water
- Hot plate or other device to heat water (Hot water from the faucet may work.)
- Spoon
- Eight clear plastic cups

Instructional activity

Content/Teacher Notes

In general, solids dissolve more rapidly in water when the water is hot because most solids simply become more soluble at higher temperatures. This is the reason sugar dissolves more quickly in hot tea than in iced tea. However, there are some solids that will not dissolve in water no matter how hot the water is. If the chemical properties of the solid are too different from the chemical properties of water, the solid will not dissolve at any temperature.

Safety Note: Be very careful that the water used in this experiment is not too hot. It is true that in this experiment, the warmer the water is, the more dramatic the results will be. However, it is not necessary to boil the water for the experiment to work. Depending on the age of your students and the likelihood that they will spill the water, you may elect to use slightly cooler water.

Introduction

Ask: Can you name any solids that you think will dissolve in water? Can you name solids that you think will *not* dissolve? Sometimes, there are ways to help solids dissolve. Can you guess any? (adding chemicals that promote dissolution, stirring or shaking the mixture for a long time, heating) This experiment will focus on one particular technique that helps solids dissolve in water — heating the water.

Procedure

1. Reveal the four solids you will be testing: salt, sugar, borax, and baby powder. Have the students discuss which ones they think will dissolve in water and come up with a group hypothesis.
2. Divide the class into groups of four students each. Give each group one spoon and four clear cups two-thirds filled with water.
3. Have the students put one spoonful of salt into one of their cups, stir the mixture, and observe what happens. Repeat the process with the sugar, borax, and baby powder.
4. As a class, discuss the results. Ask the students what they think will happen when they use hot water to dissolve these solids.
5. Give each group four cups filled with hot water. *Safety Note: Not too hot!*
6. Repeat step 3.

Observations and Conclusions

1. Ask the students the following questions:
   - Which solids dissolved in the cold water?
   - Which solids dissolved in the hot water?
   - Which solids did not dissolve at all? Why?
2. Have the students compare the appearance of the hot mixture and the cold mixture for each solid. Ask: Which ones are cloudier? Which ones are clearer? Why? Can you relate this answer to the temperature of the water?

Sample assessment

- Have the students define the term *dissolve* and give examples of everyday examples of this process.
- Ask: Can you tell which substance will dissolve more quickly in hot water than in cold water?

Follow-up/extension

- Let the solutions/mixtures from this experiment sit long enough so that all the water is cold. Now have the students compare the two cups for each solid mixture. The formerly hot solutions of borax and sugar should still be clearer, even though the solutions have cooled. This is what happens with iced tea: it is easier to sweeten tea (dissolve sugar into it) when the tea is hot. When the tea has cooled, the sugar stays in solution — stays clear — even though it would be relatively more difficult to dissolve additional sugar into the cooled tea. Help the students apply this lesson to real life by demonstrating the making of hot cocoa for the class. Let the one or more students attempt to stir powdered cocoa mix into a clear cup of cold water as the class observes how long it takes to get the powder to dissolve. Then let them dissolve the powder in hot or warm water and see how much more quickly the powder dissolves.

Resources

- *Physical Science SOLutions: Grade K–6.* Science Museum of Virginia, Virginia Department of Education. http://www.smv.org/pubs/PSSolutionsTOC2.pdf. This lesson is taken from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Mix It Up: In the Kitchen

Organizing Topic Investigating Interactions with Water

Overview This activity introduces students to the physical properties of liquids. After using their scientific skills to identify unknown liquids, students experiment with interactions between the liquids.

Related Standards of Learning 1.1a, c, d, f, g, h; 1.3a, b

Objectives

The students should be able to

- describe and apply the term *dissolve*;
- predict and describe how various materials (vinegar, milk, baking soda, powdered drink mix, sugar, salt, sand, oil, soil, rocks) will act when mixed with water.

Materials needed

- One small cup of water labeled "A" for each group
- One small cup of vinegar labeled "B" for each group
- One small cup of cooking oil labeled "C" for each group
- Three small clear cups for each group

Instructional activity

Content/Teacher Notes

Mixture. A sample of matter composed of two or more substances, each of which retains its identity and properties.

Solution. A homogeneous (same composition throughout) mixture formed when one substance (solute) has been dissolved in another (solvent).

A substance is said to be *soluble* under certain conditions if it will dissolve completely and form a solution. Oil and water are chemically very different, and they will not form a solution when combined. They will, however, form a mixture. Different kinds of oil or other greasy liquids will combine to form solutions since they are chemically similar.

Safety Note: Prior to beginning the experiment, review the safe method for smelling chemicals, which the students learned in kindergarten: waft the fumes gently toward your nose with your hand, and sniff carefully. Do not put your nose directly in or above the container.

Introduction

Ask the students: Can you always tell by looking at a liquid exactly what's in it? (No) Then how do scientists figure out what's in an unknown liquid? Tell the students that they are going to investigate some of the tests that scientists might perform.

Procedure

1. Ask: What are some different ways to identify a liquid? Elicit from the students that they could use one of their senses to do this — they could smell it. However, they should be careful using their sense of smell. *Safety Note: Emphasize that they should* never *use their sense of taste to identify an unknown substance!*

2. Divide the students into groups of three. Pass out a cup of each mystery liquid to each group.
3. Give each group a few minutes to explore the liquids by wafting and to come up with hypotheses as to what the liquids are. Encourage them to share any observations that help in identification, and write these observations on the board.
4. Pass out three clear cups to each group. Begin by having the students mix a little of liquids "A" and "B" together in one of their cups and observe the results.
5. Repeat the process, mixing "A" and "C", and then "B" and "C".

Observations and Conclusions

1. Discuss the three different mixtures. What do they have in common? What is different among them? If the class has not already identified the liquids, reveal the answers. You might want to tell them that if they mix all three liquids together, they have made salad dressing!
2. Explain that some liquids combine with other liquids to form solutions. Ask: Which two liquids in this experiment combined to form a solution? (vinegar and water) Ask: Which liquid did not mix well with the other liquids? (oil)
3. Have the students name some other liquids that they think would mix with water. Test these if there is time. Then have the students name some that they think would *not* mix well with water, and test these.
4. Discuss the concepts of solutions and mixtures with the class. Ask: Can you always tell by looking that something is a solution? (No. Scientists must often perform tests before they know for sure.) Can you always tell that something is a mixture just by looking at it? (No, not always, but in some cases you can. For example, vegetable soup is definitely a mixture.)

Sample assessment

- Have the students use the materials in the second extension activity to predict what will happen to the liquids if they shake the cup: where will the color go? (The food coloring will only mix with the water.)

Follow-up/extension

- Ask the students to use what they now know about oil and water to figure out why it helps ducks to have oily feathers. (It prevents the feathers from absorbing a lot of water and bogging down the duck. That's why we have the phrase, "...like water off a duck's back!")
- Pour a layer of oil on top of water in a clear cup. Put a few drops of food coloring on top of the oil. Have the students discuss why the food coloring stays beaded on top of the oil. (Food coloring is soluble (mixes well) in water but not in oil.)
- Shake oil, water, and vinegar together in a sealed container, and allow students to observe the separation of the oil over time.

Resources

- *Physical Science SOLutions: Grade K–6.* Science Museum of Virginia, Virginia Department of Education. http://www.smv.org/pubs/PSSolutionsTOC2.pdf. This lesson is taken from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Mix It Up: In the Yard

Organizing Topic Investigating Interactions with Water

Overview Students predict what will happen when they mix solids with water.

Related Standards of Learning 1.3b

Objectives

The students should be able to
- classify liquids and solids into those that will dissolve in water and those that will not;
- use picture graphs, tables, and/or charts to record and display the information.

Materials needed

- Sand
- Salt
- Water
- Clear plastic cup for each pair of students
- Spoon for each pair

Instructional activity

Content/Teacher Notes

Matter can exist in three states: solid, liquid and gas. Everything in the world around us is made up of matter in one of these states. Any type of matter can potentially exist in all three states, although not at room temperatures or normal atmospheric pressure. A *solid* is matter in its most organized and rigid form; a *gas* is matter in its most chaotic and dilute form; and a *liquid* is somewhere in between. For example, ice is formed when water molecules are organized and stable in a crystal structure. Ice becomes liquid when heat is added and the water molecules lose that organization. If enough heat is added, the molecules spread out a great deal, and the water becomes water vapor — a gas.

One way of viewing the differences among the three states of matter is by comparing them in terms of their volume and shape characteristics:

- A solid has a definite volume and shape.
- A liquid has a definite volume but takes on the shape of its container.
- A gas takes on the volume and the shape of its container.

Introduction

1. Begin a discussion of solids, liquids, and gases by asking the students to name some examples of matter in each state. Help them come to an understanding of the differences. You may want to review these concepts by having the students participate in the following exercise that will help them gain a better idea of how molecular relationships change from solid to liquid to gas.
2. Define *molecule,* and ascertain that the students understand that all matter is made up of these little tiny particles. Have the students demonstrate molecules in a Molecule Demonstration:
    - To demonstrate a solid, tell the students: Each of you represents a “molecule.” Stand still, stand really close together, and hold hands. Don’t move a muscle! You are acting like the molecules in a solid.

- To demonstrate a liquid, tell the students: Hold hands, but spread out and move around *slowly*. You are acting like the molecules in a liquid.
- To demonstrate a gas, tell the students: Spread out in the room without holding hands, and move around very quickly. Now you are acting like the molecules in a gas.

Procedure

1. Before passing out any materials, ask the students to name solids that they have mixed with water before. Prompt the class to name some solids that dissolved and some that did not dissolve.
2. Divide the class into pairs. Give each pair a clear cup about two-thirds full of water. Place containers of salt and sand on the tables.
2. Have each pair add two spoonfuls of salt to the water, stir, and observe what happens to the salt.
3. After the salt has dissolved, have each pair add two spoonfuls of sand to the water, stir, and observe what happens.

Observations and Conclusions

1. Ask: What happened to the salt when it was added to the water? (When the salt, which is a solid, was added to the water, which is a liquid, it dissolved. The salt was soluble.)
2. Ask: What happened to the sand when it was added to the water? (When the sand, also a solid, was added to the water, it sank to the bottom of the jar. The sand was not soluble.)
3. Ask the students to name some other solids that are soluble in water and some other solids that are *not* soluble in water.

Sample assessment

- Give the students two unidentified solids, only one of which is soluble, and a cup of water. Have them determine which solid is soluble in water.

Follow-up/extension

- Repeat the experiment, but attempt to dissolve the salt and the sand in oil or vinegar. (The salt will dissolve in the vinegar, but the sand will not. Neither solid will dissolve in oil.) Just because a solid will dissolve in water doesn't mean it will dissolve in every liquid!

Resources

- *Physical Science SOLutions: Grade K–6.* Science Museum of Virginia, Virginia Department of Education. http://www.smv.org/pubs/PSSolutionsTOC2.pdf. This lesson is taken from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Organizing Topic — Investigating Motion

Related Standards of Learning

1.1 The student will conduct investigations in which
- a) differences in physical properties are observed using the senses;
- b) simple tools are used to enhance observations;
- c) objects or events are classified and arranged according to attributes or properties;
- d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- e) length, mass, and volume are measured using standard and nonstandard units;
- f) predictions are based on patterns of observation rather than random guesses;
- g) simple experiments are conducted to answer questions; and
- h) inferences are made and conclusions are drawn about familiar objects and events.

1.2 The student will investigate and understand that moving objects exhibit different kinds of motion. Key concepts include
- a) objects may have straight, circular, and back-and-forth motions;
- b) objects may vibrate and produce sound;
- c) pushes or pulls can change the movement of an object; and
- d) the motion of objects may be observed in toys and in playground activities.

Essential Understandings, Knowledge, and Skills	Correlation to Textbooks and Other Instructional Materials

The students should be able to

- make and communicate observations about moving objects. Examples should include balls, objects with wheels, windup toys, tops, rubber bands, and playground equipment; _____
- predict an object's movement, using its size, shape, and the force of the push or pull on it; _____
- conduct a simple experiment to determine an object's movement; _____
- describe and classify the motion of an object as straight, circular, curved, or back-and-forth; _____
- understand that vibrations may create sound, such as humming, strumming a guitar, or plucking a rubber band; _____
- record observations of movement (length/distance), using standard (English/metric) and nonstandard units; _____
- compare the movement of objects, using graphs, pictures, and/or numbers. _____

Let's Be Motion Detectives

Organizing Topic Investigating Motion

Overview Students investigate different kinds of motion and find out how pushes and pulls can cause changes in an object's motion.

Related Standards of Learning 1.1a, c, d, h; 1.2a, b, c, d

Objectives

The students should be able to
- conduct a simple experiment to determine an object's movement;
- describe and classify the motion of an object as straight, circular, curved, or back-and-forth.

Materials needed

- Tuning fork
- Pan of water
- Motion Detective Data Sheets (see pp. 63–65) for each student

Instructional activity

Content/Teacher Notes

Use your version of the following to prepare the class to be Motion Detectives on a data-gathering expedition: Tell the class that they are going to become scientists for the day. In fact, they will be *physicists*! Let them learn how to pronounce this big word. Ask: What do physicists study? (Physicists study the physical world, or the stuff in the world around us. They study objects, energy, and work. Many physicists study how things move and the pushes and pulls — the forces — that cause things to move. Good physicists are great detectives!) Ask: Can anyone tell me what detectives do? (Detectives use their eyes and ears to notice things. Good detectives, like the detectives who try to find Carmen Sandiego in the television show or like Sherlock Holmes, notice things all the time. Scientists call this *making observations.*)

Introduction

Tell the students: Let's go on a walk today and be good scientists and excellent Motion Detectives. We're going to look for different kinds of motion and figure out what causes them.

Procedure

1. Have the students take a walk in the school neighborhood, around the playground, or just through the school building, stopping at intervals to notice different kinds of motion. Examples are swings, which have back-and-forth or pendular motion; wheels, which have circular motion; and falling objects, which have straight motion. (You may want to be prepared with some objects to drop. Wooden blocks work well since it's easy to see that the blocks are not turning in a circular motion as they fall.)
2. When you return from the walk, make a list of all the different kinds of motion you observed. Have the students come up with the push or pull that caused these motions. For example, pushing a swing makes it move; a car's engine provides the push that makes the wheels on the car turn; a mother pushing a baby carriage provides the push that makes those wheels turn; gravity provides the pull that makes an object fall. (The students may be familiar with the pull of gravity from

hearing about astronauts. At this level, you probably just want to explain that gravity is the force that pulls things toward the Earth.)

Sample assessment

- Give each child a copy of the three Motion Detective Data Sheets. Explain that the word *data* is used by scientists to mean facts or information. Ask them to use the sheets to draw one or two pictures of the kind of motion listed and shown at the top of each sheet.

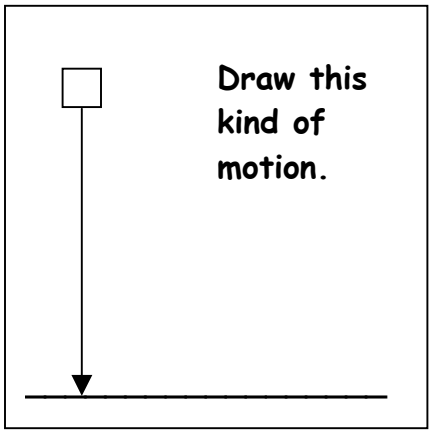
Follow-up/extension

- Ask each student to discuss different kinds of motion with his/her family. Have each student pick a toy that moves and bring it to class. (Cars, trucks, yo-yos, and pull-toys are all good choices.) Each student should be prepared to tell the class what kind(s) of motion the toy shows and to describe the push or pull that makes it move.

Resources

- *Physical Science SOLutions: Grade K–6.* Science Museum of Virginia, Virginia Department of Education. http://www.smv.org/pubs/PSSolutionsTOC2.pdf. This lesson is taken from this source.
- *Outstanding Science Trade Books for Students K–12.* National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Motion Detective Data Sheet 1



Straight Motion

Detective's Name: _____

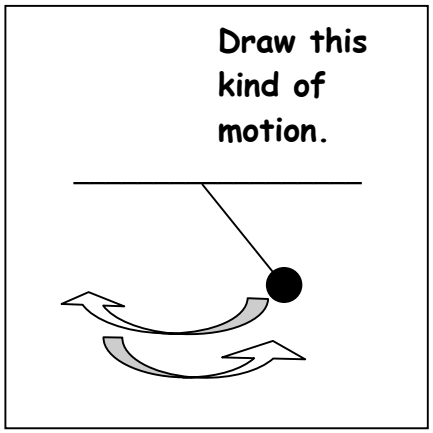
Motion Detective Data Sheet 2

Draw this kind of motion.

Circular Motion

Detective's Name: _____

Motion Detective Data Sheet 3



Back-and-Forth Motion

Detective's Name: _____

Sail On

Organizing Topic Investigating Motion

Overview Students conduct an investigation to compare how far their boat will move, using different amount of air to propel it.

Related Standards of Learning 1.1d, e, f, g, h; 1.2c, d

Objectives

The students should be able to

- make and communicate observations about moving objects. Examples should include balls, objects with wheels, windup toys, tops, rubber bands, and playground equipment;
- predict an object's movement, using its size, shape, and the force of the push or pull on it;
- record observations of movement, using standard (English/metric) and nonstandard units;
- compare the movement of objects, using graphs, pictures, and/or numbers.

Materials needed

- Sail-On Data Sheet (see p. 67) — one for each pair of students
- Crayons
- Pint-size milk cartons — one for every four students
- Small balloons — one for each pair of students
- Scissors
- Tape measures or meter sticks
- Large container of water (a child-size wading pool, a wallpaper tray, or a closed length of gutter to use to sail the boats)
- Boat Travel Graph (see p. 68) — one for each pair of students
- Boat Pictures sheets (see p. 69)

Instructional activity

Content/Teacher Notes

This is a great experiment to do outside in nice weather, with students working in pairs or small groups. Mark the bottom of the pool in inches before you fill it so that students can measure the distances that their boats travel. Mark a starting line. The pool does not need to be filled to the top. If time permits, students may paint and decorate their boats, perhaps as an art activity.

Introduction

Ask students to name some ways to propel a boat. Ask: Which way do you think is best? What are some things that affect how far or fast a boat can travel? Have students discuss the difference between moving a large boat and moving a small boat, and between moving a heavy boat and a light boat.

Procedure

1. Cut the milk cartons in half from end to end, making two "boats" out of one carton. Cut each carton so the point is not destroyed: this is the "bow" of the boat. Glue the opened bow closed again. Punch a hole in the center of the back of each boat, close to the bottom. Push the tip of a balloon through this opening, with the balloon lying inside of the boat and the tip sticking out.
2. Distribute the boats — one for each pair of students. If time allows, let the students decorate their boats with color. After the pairs complete their boat, have them complete their predictions on the

Sail-On Data Sheet about how far the boat will go with three, with five, and with seven puffs of air.

3. Have the students blow three puffs of air into the balloons and hold the ends closed until they are ready to put their boat on the water at the starting line. Caution students that for the experiment to work, they should use the same amount of air in every "puff" every time.
4. Have students, one by one, put their boat on the starting line, let go, and record the distance the boat travels.
5. Have them repeat steps 4 and 5 for five puffs of air.
6. Have them repeat steps 4 and 5 for seven puffs of air.
7. After all students have recorded their data, have them graph their predicted and actual distances, using the boat pictures in the Boat Travel Graph.

Observations and Conclusions

1. Hold a class discussion, using the following questions:
   - Does the boat move further with more puffs of air? Why?
   - How could you change the boat to make it go faster?
   - Were your predictions accurate?
   - Did you give the boat a "push" or a "pull" to make it move?

Follow-up/extension

- Direct the students in making paddleboats, using milk cartons and rubber bands, and have them compare these boats with the balloon boats.

Resources

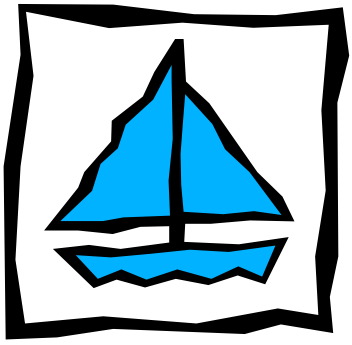
- *Outstanding Science Trade Books for Students K–12*. National Science Teachers Association (NSTA). http://www.nsta.org/ostbc.
- *Search for Literature: Literature for Science and Mathematics*. California Department of Education. http://www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. Web site with searchable database.

Name: _____

Sail-On Data Sheet

Predict:

Number of Puffs	Distance in inches
3	
5	
7	



Investigate:

Number of Puffs	Distance in inches
3	
5	
7	

Name: _____

Boat Travel Graph

Directions:

Cut out the boat pictures. Paste them in the blocks to show how far you predicted your boat would go and how far it actually went.

3 Puffs

Distance	Predicted	Actual
24		
22		
20		
18		
16		
14		
12		
10		
8		
6		
4		
2		

5 Puffs

Distance	Predicted	Actual
24		
22		
20		
18		
16		
14		
12		
10		
8		
6		
4		
2		

7 Puffs

Distance	Predicted	Actual
24		
22		
20		
18		
16		
14		
12		
10		
8		
6		
4		
2		

Boat Pictures