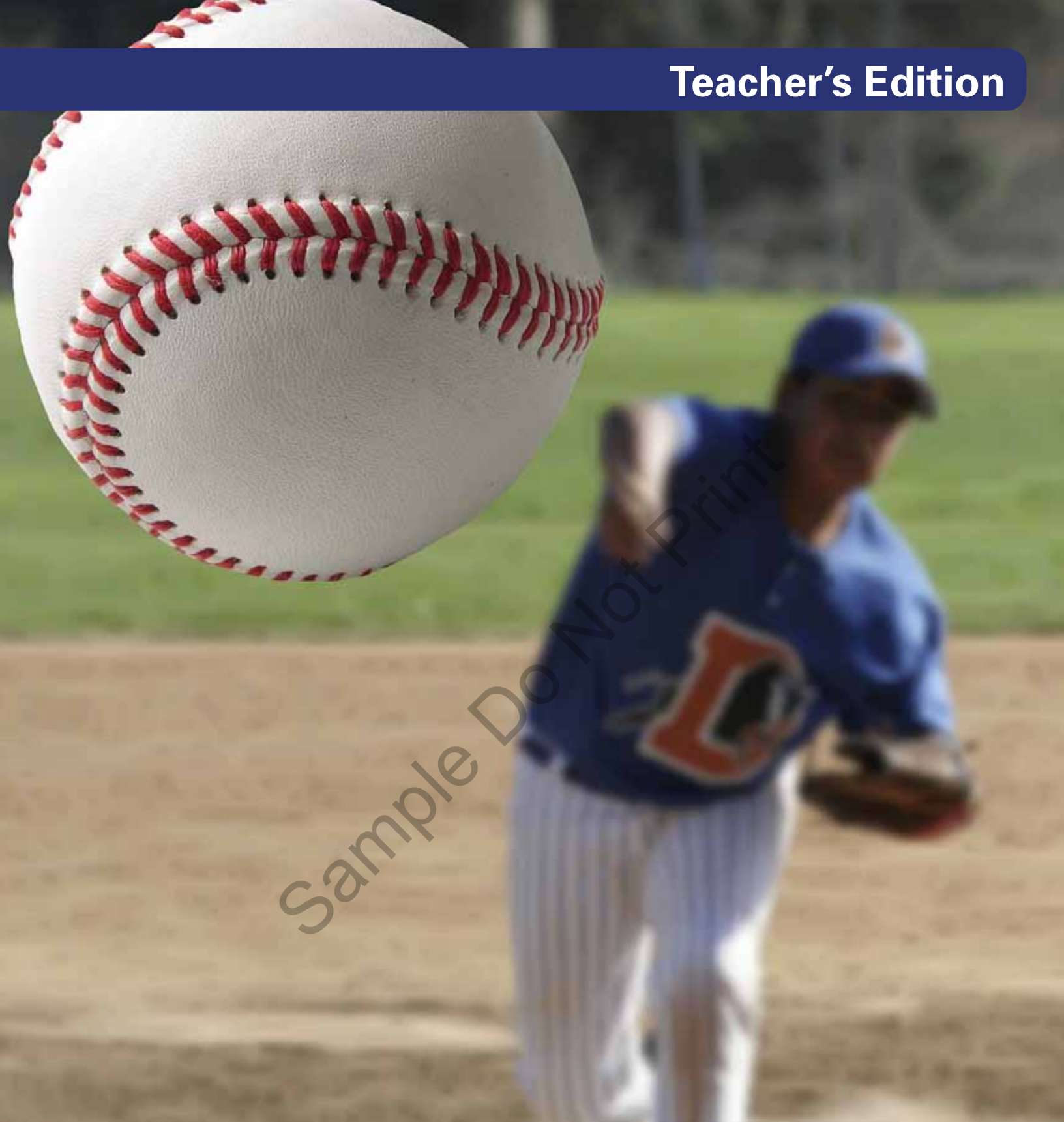


Teacher's Edition



Sample Do Not Print

Sangari Active Science

# Motion and Energy



# Motion and Energy

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# Motion and Energy

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# Introduction to Teachers

The standards-based *Sangari Kindergarten Investigation Centers Program* is designed around grade level theme topics that allow students to develop awareness of the world around them and their place in it. Using real-life science connections, the program is designed around a student investigation center approach. This approach is based on pedagogical research that indicates centers are the most appropriate method to engage kindergarten students in science to explore topics using the tools of science, and explain the science they have discovered. For the teacher's ease, the program provides everything needed for student investigation centers, including well-designed hands-on activities with corresponding objects to examine, and creates an active learning environment that brings the natural and physical world to life in the kindergarten classroom.

## Purpose

Student investigation centers engage students in real science processes and help teachers manage whole class and small group structured learning, with rotations in which students apply what they have learned with developmentally-appropriate activities both independently and with partners. Investigation centers and their "hands-on" approach help students master meaningful concepts and connections across the content of science, math, reading, and language arts with activities that are interesting and challenging. Teachers assess students informally through consistent observation and interactions as they facilitate center activities and assess students formally with included activities in the *Evaluate: Reflect on the Skill* section.

## Lesson Design

The *Sangari Kindergarten Investigation Centers Program* is designed around three primary activities in which students engage in real-life problem-solving skills, social interaction, cooperative learning, and hands-on learning:

- Work with Teacher (either entire class or in groups)
- Investigation Center with Partners (can include small groups)
- Independent Investigation Center (can include partners)

# Time for Centers

The theme lessons are designed to be flexible for the kindergarten class schedule. No matter how frequently centers are changed, the activities will work for the kindergarten class. If teachers change the centers weekly, an effective schedule is for teachers to instruct the whole class with the sections *Engage: Start the Lesson*, *Explore: Introduce the Concept or Demonstration*, and then set up the *Explain: Learn with Center Partners* activity in week one. That schedule allows teachers to lead students through background information and center activity instructions. Students can then work at the center with guidance from the teacher or a class volunteer. It usually takes a week for all students to rotate through the science center. The teacher can reinforce science concepts with read-alouds from the suggested theme trade books. The following week, the *Explain: Learn More with Independent Investigation Center* can be set up to reinforce the science skills. That schedule allows a kindergarten class to complete a lesson in two weeks.

Some kindergarten classes have both centers set up at the beginning of the first week. Teachers instruct the whole class with the sections *Engage: Start the Lesson*, *Explore: Introduce the Concept or Demonstration*, and trade book read-aloud. Then students rotate through both science centers since the activities are independent of each other. The *Elaborate: Extend the Learning* letter can go home that week, as appropriate. That schedule allows a kindergarten class to complete a full lesson with both centers in one week.

The theme lessons are also flexible for weeks that are short due to holidays, weather, or school events. A teacher can decide how many centers to set up for the time available. The materials at a center can remain in place over long weekends, so all students can rotate through the activities. The lesson flexibility is in place to meet the needs of a kindergarten class throughout the school year. The trade books provide a perfect review for skill concepts or scientific methods so teachers can return to them often to keep science topics alive in the classroom.

# Lesson Design

Sangari Investigation Centers are designed as inquiry-based learning. The lessons involve the learner and provide opportunities for the teacher to lead students to understanding. During the demonstrations and center activities students are encouraged to question, test, and use their senses to understand new information. The lessons provide questions for a teacher to use giving students the opportunity to connect information they already know to new information. The lessons follow the pattern of the research-based five “E”s.

## Engage: Start the Lesson

This section starts the investigation center cycle as the teacher facilitates students making connections to background information and the theme topic usually to the entire class or a group. The teacher introduces and uses science vocabulary words while reading aloud theme-based trade books, and demonstrating science concepts with hands-on activities. To prepare students, the teacher describes the center purpose and projects and reinforces how to conduct the center.

## Explore: Introduce the Concept or Demonstration

The teacher introduces, models, and practices the investigation center activities before students work independently or with partners and small groups. The teacher prepares students to use the investigation centers by modeling the activities and allowing students to practice with supervision. This encourages sharing and talking about the science concepts. Students are able to take notes and draw to prepare for working at investigation centers by writing in their personal *My Science Notebook*.

## Explain: Learn with Center Partners

These activities allow students to examine related science objects, gather and display data, use science tools, and follow step-by-step directions, with the support of a partner or small group. Students conduct investigations in which they:

- understand basic properties of objects.
- make observations from different perspectives.
- sequence objects according to size or group them based on attributes.

- describe objects and investigations orally and in images.
- construct and describe picture graphs.
- develop and answer open-ended or “what if” questions.
- measure nonstandard and standard units.
- chart and describe expected and unexpected results of activities.

Investigation centers include ample materials needed for student explorations, organized in sturdy containers. Each activity is noted in the TE (Teacher’s Edition) with a separate materials list next to it. This level of organization ensures that teachers can plan appropriately so that all materials needed can be prepared and are available. Students gather data or observations in their personal *My Science Notebook* for the engaging, hands-on activities.

## Explain: Learn More with Independent Investigation

This section allows students to reflect and practice what they have learned on their own or with a partner for support. Multiple activities provide differentiation to address a range of student needs in kindergarten. Writing activities including book making, vocabulary reinforcement with games and puzzles, post-reading fiction, nonfiction, poetry, math connections with patterns, sorting, measuring, calendar work, and graphing.

## Evaluate: Reflect on the Skill

*Sangari Kindergarten* provides activities for the teacher to conduct informal assessments individually or in small group settings to determine overall comprehension of skills. These can be used at any point in the theme unit if a teacher needs to evaluate students. Student’s *My Science Notebook* is a good source for evaluating the students’ understanding of concepts. Since discussion and questioning is an important part of inquiry-based learning, evaluation includes careful listening to student responses.

## Elaborate: Extend the Learning

These activities are typically prepared as family connections so students can share their new knowledge. Sometimes, this section includes short letters providing parents information about the science skill instructed at the centers and they include ways parents can reinforce science skills at home or other places in the community since there are multiple real-life connections for science.

# Program Components

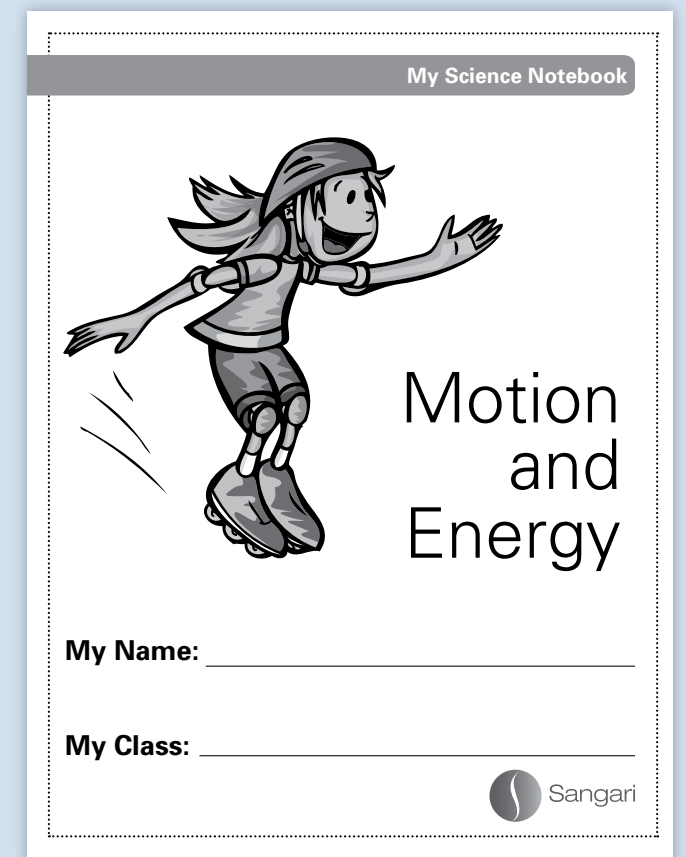
The components of the *Sangari Kindergarten Investigation Program* are:

- Teacher's Edition
- *My Science Notebook*
- Investigation Center Kits

The *Teacher's Edition* contains five lessons per theme unit. Each lesson provides the science vocabulary, the science content for the theme unit, short readings appropriate to read aloud to students, and activities to introduce the science content. The *Teacher's Edition* contains a full description of investigation center activities with modeling language and questioning strategies to support the teacher in presenting the centers to students.

A *My Science Notebook* is provided for each student. The notebook contains large-scale graph paper and blank paper so students can create picture graphs and illustrations of their observations. Activity sheets are included in the *My Science Notebook* to help students organize, describe, and explain the science from their exploration.

*Investigation Center Kits* are provided for each theme study. The kits are presented in sturdy tubs that organize materials and allow for easy storage or movement of materials. The center kits contain the materials and tools needed for active, hands-on science, such as plastic magnifying glasses, and a mat with four sections for sorting materials and magnets. The kit contains materials for independent investigation centers to reinforce vocabulary and literacy including independent reading, writing and book making, and science puzzles.



# Theme Overview

The purpose of this theme is for kindergarten students to explore all the ways things can move, and to describe the words used that define movement. Students become aware of the effect of force on movement and how force can be used to change the direction of something in motion. They are introduced to moving things without touching, instead using magnets. This unit is designed to align with the following standards.

- Describe the various ways that objects can move.
- Demonstrate that the way to change motion is to apply force.
- Explore the effect objects have on others even when they are not touching.
- Describe Earth's gravity as a force that pulls objects to the earth without touching the object.
- Describe an objects' position relative to another object.
- Compare the speeds of two moving objects.
- Explore how things make sounds.

- Determine that light travels in a straight line.  
Students will:
- apply a force to an object (push or pull) and demonstrate the greater the force the greater the change in motion of the object;
- investigate ways to change how something is moving;
- explore the effect magnets have on objects; and
- demonstrate ways to change directions when something is moving.

## Explore the *Big Idea* through Investigation Centers

In the first investigation, students explore objects moving in various directions including up and down, back and forth, zigzag, and being still. The vocabulary developed in the first investigation is built upon throughout the unit. In the second investigation, students identify the effect of gentle force and greater force on objects and they use force to make things move and to stop them from moving; gravity is introduced in this investigation. In the third investigation, students use various shaped magnets to make things move. Students use a poem to reinforce position words. In the fourth and fifth investigations, students explore light, heat, and sound energy with activities that involve vibration, hot and cold, and light.

# Centers Overview

## Investigation Center One

**Big Idea:** *What Are Different Ways Things Can Move?*

Things move by changing their position along a path or stay still with no movement. In *Investigation Center One*, kindergarten scientists learn the names of movements that objects can make such as up and down, back and forth, circular, or zigzag motions. Students explore movement with spinning markers and they share concepts from a trade book that clearly demonstrates these ideas.

## Investigation Center Two

**Big Idea:** *How Do Objects Move?*

Objects move when a force is placed on them. Kindergarten scientists have had real-life experiences that help them relate to the concept presented in this investigation, which is the idea that the amount of force placed on an object relates to the amount of movement. The concept of gravity is introduced as students drop items to make them move, and they explore movement by placing force on rolling toys and observing the effect.

## Investigation Center Three

**Big Idea:** *Can Objects Move Without Being Touched?*

Magnetic force can move things without touching them. Concepts of attraction and repulsion are concepts that kindergarten scientists can understand with hands-on activities and experiences with bar magnets, horseshoe magnets, and floating magnets. Students explore different materials that are attracted to magnets and how many items they attract to a magnet.

## Investigation Center Four

**Big Idea:** *How Do We Use Words to Describe the Position of an Object?*

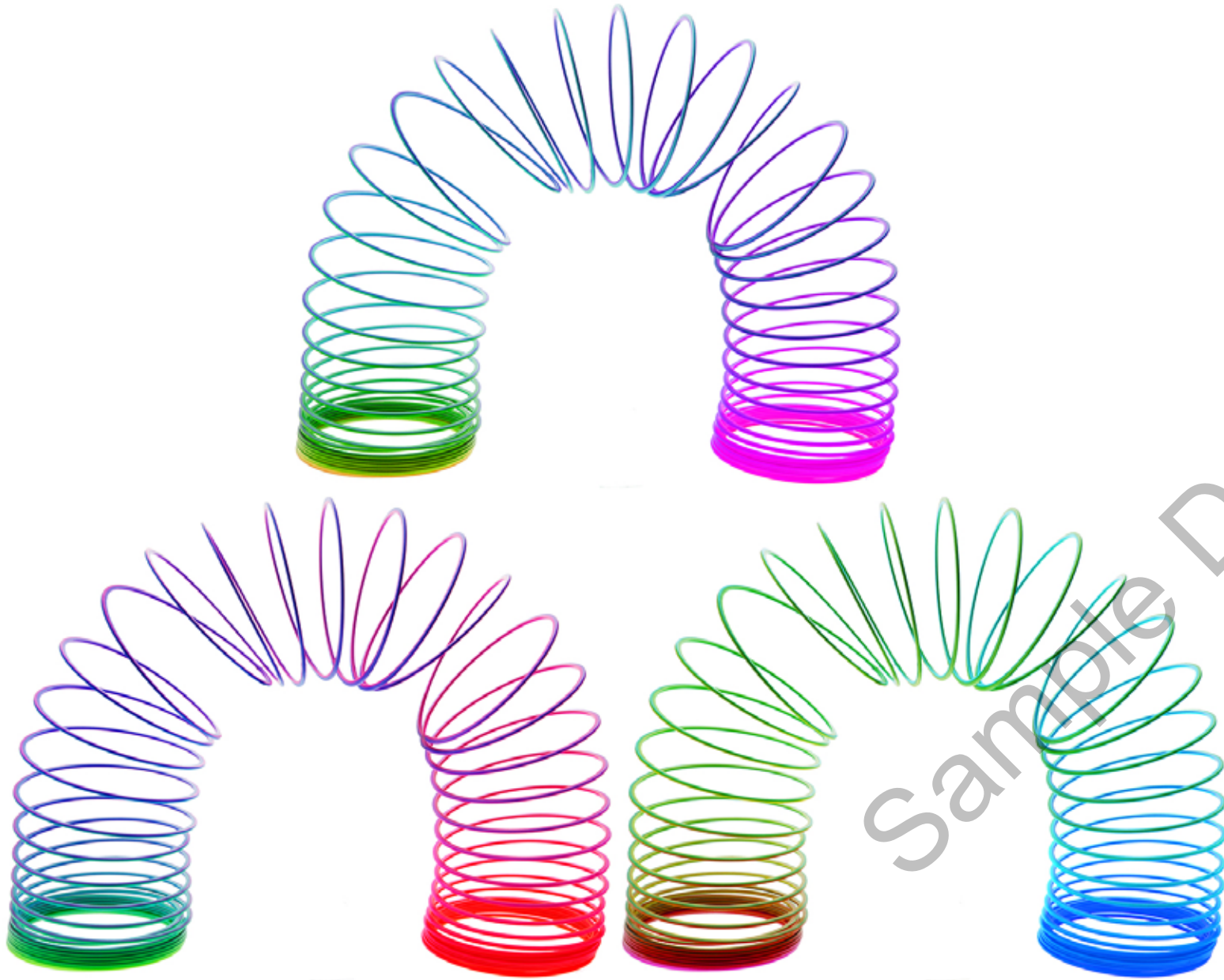
Changing positions of objects (movement) requires young scientists to increase their vocabulary to use correct position words. Concepts of position (above, behind, below, bottom) are reinforced with poems and games as well as the concept that a student can be in two positions at once such as behind one student while in front of another. Students explore that if they change their body's position (move), objects around them need different position words to describe where the objects are in relation to the change.

## Investigation Center Five

**Big Idea:** *What Is Energy?*

Energy is a force that makes things happen such as motion, sound, heat, and light. This concept deepens young scientists' understanding with concepts of force when they explore sound energy through vibration, and heat energy with warm water and ice cubes. Students convey their understanding of force and energy when they differentiate between heat energy, sound energy, and light energy.

# What Are Different Ways Things Can Move?



## INVESTIGATION CENTER ONE

# **Big Idea:** What Are Different Ways Things Can Move?

### Lesson Overview

**Discuss** the *Big Idea*: What are different ways things can move? (*Things move by changing their position. Things can move up/down, back/forth, and in circular motions.*)

**Observe** the path of movement or the direction of a movement.

**Identify** the names of certain movements and the names of the path of movement such as zigzag.

**Recognize** how common items move and stay still.

**Discuss** movement using correct vocabulary.

- **move** – to change position
- **path** – direction of movement
- **still** – having no movement

**Explore** the *Big Idea* by creating a picture with spinning markers, and perform a shared reading of *Things That Move* or another similar book on this topic.

**Evaluate** understanding by assessing students' rationale for selecting common items they think will move (roll or slide).

**Elaborate** by determining wooden shapes that can roll or slide.

### Objectives

Students will

- explore all of the ways a Slinky® can move; and
- determine which common items are always moving.

### Preparing for the Lesson

- 1 Prepare for small group work in the science activity center by reading through the *Engage* and *Demonstrate* sections of the investigation.
- 2 Review the *Explore* section of the investigation and ensure the necessary materials are readily available.
- 3 Check with your school librarian to locate a copy of the book, *Things That Move* (Usborne Very First Words), or other trade books that cover the topic of movement.
- 4 Practice with the Slinky® so that the different paths of movement can be easily demonstrated.

## Engage: Start the Lesson

### MATERIALS

- (1) clock with a second-hand\*  
\*Not included in kit

Discuss what it means to move. Ask students to describe ways that things can move. Use the vocabulary words in this investigation as you read and discuss this topic so that students become familiar with words that describe movement.

Assess students' prior knowledge of the concept of movement by examining the classroom clock. Have students tell a peer what movement they see. (*Besides the numbers and hands, they should see the second-hand moving around in a clockwise motion.*)

Ask what it means for something to move? Explain that when something moves, it changes position. Point out that the second-hand on the clock is moving, and ask what kind of path it takes. (*It is moving around a circle.*)

Select two student volunteers. Have one volunteer walk around the classroom while the other tries to stand perfectly still. Ask the following inquiry questions to stimulate discussion.

- Which classmate is moving? (*The one that is walking.*) Point out that the position of this student is changing.
- Which classmate is standing still (or not moving)? Explain that the student who is standing still does not have a change in position.

Encourage all students to be perfectly still for 30-seconds. (Use the sand timer from the *Think Like a Scientist* Unit for timing purposes.) After 30-seconds have passed, ask students if they were able to stay perfectly still. Point out that although they were not walking around, people are always moving. They are breathing, their hearts are beating, and they usually blink their eyes.

Make a list of other things students know that can move besides clocks and people. Record responses on the board in view of all. Students may suggest objects such as cars, airplanes, dogs, elevators, trees in the wind, and water in rivers. Ensure a diverse sampling of responses.

Read aloud the book, *Things that Move*, and discuss the movement concepts mentioned. If this book is not available, select another title with similar content that allows such a discussion with the class. After the reading, review the concept of movement. Ensure students understand that when something moves, it changes position. Also, point out that the path something takes is the direction of movement.

Return students' attention to the clock and discuss the concept of the path of movement. (*The second-hand moves in a circular path.*) Select a student to make a circular movement with his finger in the air. After it is successfully demonstrated, have all students make a circular movement with their fingers.

Continue the topic of movement by asking the following inquiry questions and having students demonstrate a variety of movements.

- What are some directions things can move? (*Cars can move forwards, backwards, and turn; elevators move up and down; tops spin in circles.*)
- Guide students to make an up and down movement with their fingers. Ask them to identify specific items that move in an up and down motion.
- Have students to make a back and forth movement with their fingers (away from, and then back towards their body.) Ask them to identify specific items that move back and forth.
- Demonstrate a zigzag path by moving your finger in a 'Z' shape. Ask students to use their fingers to copy the path. Ask them what might move in a zigzag pattern.
- Challenge students to demonstrate other types of movements with their fingers.

## Explore: Introduce the Concept

- 1 Show students the Slinky® and explain that you are going to use it to demonstrate different kinds of movement. Reinforce vocabulary by encouraging the correct use of movement words.
- 2 Stand the Slinky® on the floor and ask if it is moving. (*It is not moving when it is sitting still.*)
- 3 Place the Slinky® on its side and ask students how they could get it to move. (*by pushing it*) Push the Slinky® and ask students to observe what happens.
- 4 Ask what path the Slinky® is taking. How is it moving? (*The Slinky® is rolling in circles, and also moving along the floor.*) What other things do students know that can roll in circles? (*wheels, balls, marbles, tubes*)
- 5 Hold one end of the Slinky® and let the bottom fall, then gently move your hand so the Slinky® moves up and down like a yo-yo. Ask:
  - How the Slinky® is moving now? (*It is moving up or down, or bouncing.*)
  - What other things move up and down? (*Elevator, escalator, people on stairs, the red line in a thermometer, helicopter, balls that are thrown into the air or bounced on the ground*)

### MATERIALS

- (1) Slinky®

- 6 Hold the Slinky® in front of your chest with one end in each hand. Wiggle it so that it is moving back and forth in front of you. Ask students how the Slinky® is moving. (*back and forth*) Ask what other things move back and forth? (*some trains, trees moving in the wind, students going to the cafeteria or other rooms in the school*)
- 7 Hold the bottom end of the Slinky® between your feet (or have a student hold it) and stretch it out. Make slight back and forth and up and down movements of your hand until the Slinky® is making a zigzag motion. Ask:
  - How the Slinky® is moving now?
  - What other things can move in zigzags? (*lightening, runners*)
- 8 Hold the Slinky® in front of your chest with one end in each hand (about eight inches apart). Move your hands in small circles until the Slinky® is moving round and round like a jump rope. Ask:
  - How is the Slinky® moving now? (*in circles*)
  - What other things move round and round in a circle? (*jump ropes, hands on clocks, wheels*)

Direct students to the activity *Things that Move* in their *My Science Notebook*. Ask students to draw a picture showing one of the positions the Slinky® was moving.

**MY  
SCIENCE  
NOTEBOOK**

Activity

**Things That Move - Slinky®**

Draw a picture in the box below of the Slinky® and one of the ways the Slinky® moves.

2 My Science Notebook : MOTION AND ENERGY

## Explain: Learn with Center Partners

This independent or partner activity encourages students to observe and describe the movements made by tops (spinning markers) after they are twirled.

- 1 Explain that the spinners have markers on their tip that will show the path they take after they are twirled. Demonstrate how to remove and replace the cap on the marker part of the spinner.
- 2 Direct students to twirl the spinner with the marker cap on. Have them focus on the round and round circular movement the spinner makes. Ask them what will happen if the spinner is twirled with the cap off. (*It will draw a line that shows the path of the spinner.*)
- 3 Have students take the cap off and twirl the spinner. Remind them that when the cap is off, they must always use the spinner on paper and not anything else. Students should observe and describe what is happening. (As the spinner spins in circles, it is also moving along a path.) What do the paths look like? Are they straight, curved, in twirls or other shapes?

Have students draw what happened with the spinners on the *Spinning Markers* page in their *My Science Notebook*. They may also attach their original 'spin art' to the sheet.

**MATERIALS**

- (6) spinning markers
  - sheets of white paper\*
- \*Not included in kit*

**MY  
SCIENCE  
NOTEBOOK**

Activity

**Spinning Markers**

Draw a picture in the box below of the spinning markers and how they moved.

3 My Science Notebook : MOTION AND ENERGY

## Evaluate: Reflect on the Skill

This in-class assessment activity can be completed with the whole class or small groups assisted by a parent volunteer.

This activity encourages students to find something in the classroom that can roll.

- 1 Challenge students to look around the classroom and try to find two objects that can roll down the clipboard or tray.
- 2 Have students test the objects and then draw the two objects on the *Objects that Roll* worksheet in their *My Science Notebook*.
- 3 Ask students to describe the movement of the objects using the science vocabulary that has been emphasized throughout the lesson.

### MATERIALS

- (1) clipboard or tray\*
  - everyday classroom materials\*
- \*Not included in kit

Unacceptable Progress	Acceptable Progress	Exceptional Progress
Student is unable to identify two objects that can roll in a downward motion.	Student is able to identify two classroom objects that can roll downward AND accurately draw them in his or her <i>My Science Notebook</i> .	Student is able to identify more than two objects that can roll downward OR additional motion patterns AND illustrate at least two of these in his or her <i>My Science Notebook</i> .

**Activity**

**Objects that Roll**

Find two objects in the classroom that can roll down the clipboard or tray.

Draw a picture of the objects in the box below.

4
My Science Notebook : MOTION AND ENERGY

## Elaborate: Extend the Learning

This partner or independent activity encourages students to compare objects that roll with objects that do not. The activity can be completed if there is extra center time or if review for concepts is needed later.

### Preparation

Rest one end of the clipboard or tray on a pile of books so that it is inclined towards the desk. Place several differently-shaped blocks on the table.

Ask the following inquiry questions to stimulate discussion.

- 1 What shapes do students recognize in the blocks? (*squares, circles, triangles*)  
Have students name and pick up the shapes they know.
- 2 Will any of these shapes roll if they are pushed? Have students explain which shapes they think will roll and why.

Show students the clipboard/tray and explain that they are going to try to roll different blocks down the clipboard. Demonstrate by placing the square on the clipboard/tray and letting it go. Ask students if it rolls. (*No, but it may slide down.*) Place one of the circular-shaped blocks on the clipboard and let it go. Does it roll? (*yes*)

Allow students to test all the shapes to see which ones roll. Describe the shapes that rolled and the ones that did not roll. Do the shapes have any similarities or differences? (*The round shapes are more likely to roll.*)

Students can look at the worksheet page, *Does It Roll?* in their *My Science Notebook* and circle the picture of all the shapes that rolled down the clipboard. If any shapes on the page are not available on the table, students can cross those off the page.

### MATERIALS


- (1) clipboard or tray\*
- (1) pile of books\*
- (1) wood block set
- everyday classroom materials\*

\*Not included in kit

**Activity**

**Does It Roll?**

Circle the pictures that show the blocks that were able to roll down the clipboard or tray.



My Science Notebook : MOTION AND ENERGY 5